ELECTRICAL WORLD

JULY 16, 1932
McGraw-Hill Publishing Company, Inc.
25 cents per copy

THE TREND TODAY IS TOWARD PYREX POWER INSULATORS

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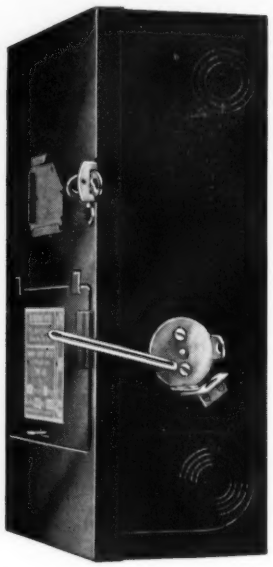
IN PRODUCTION!

THE NEW MURRAY ONE OPERATION ACCESSIBLE FUSE SWITCHES

HANDLE OPERATION OF MURRAY ACCESSIBLE FUSE SWITCHES SHOWING "ON," "OFF" AND "OPEN DOOR" POSITIONS.

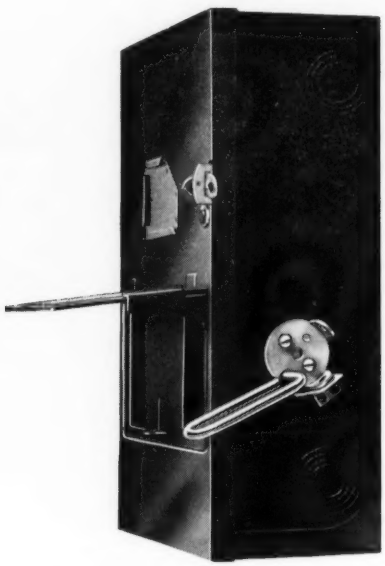
SWITCH HANDLE IN "ON" POSITION

Auxiliary door for fuse Accessibility cannot be opened while switch handle is in the "ON" position.



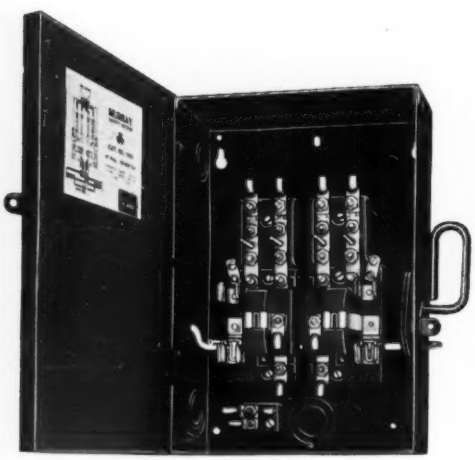
SWITCH HANDLE IN "OFF" POSITION

Service is disconnected, but fuses are not accessible until handle is brought to "Open Door" position.



SWITCH HANDLE IN "OPEN DOOR" POSITION

Auxiliary door automatically opens for fuse accessibility when handle is in "Open Door" position. All current carrying parts are dead.



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Catalog No. 1065 — 60 amp. — 3 wire — 125-250 V. — 2 fuses neutral solid.

IN the forerunner of accessible fuse switches — the Murray Rotary Switch — there was one feature that distinguished it from all others, i.e., one operation — moving of handle to "OFF" position, disconnected current and brought fuses to view. This outstanding achievement is also incorporated in the new construction, for handle has complete switch and auxiliary cover control for accessibility of fuses.

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ELECTRICAL WORLD

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for the Week Ending

July 16, 1932

Imitation of Large Business Bad Policy for Small

SMALL plant operators should tend to their own knitting and not spend too much time imitating the programs and *modus operandi* of their larger competitors. That was the theme of the remarks of D. R. Stevens, vice-president of the Okonite Company, Passaic, N. J., in addressing the session of the second annual conference on Smaller Industries at Silver Bay, Lake George, N. Y., on Monday. He said:

While the giant industries spend great amounts of time and money to create spirit, the spirit thus created is largely artificial. The maze of managers, assistants, supervisors and general executives which are found in every corner of large industry today breaks down effective contact between the leader and the men, no matter how broad-gaged the leader may be. The small plant may fall into the same bad habits by copying the large plant, but the small plant, under broad-minded leadership, has every possibility in the world of making the better comparative showing.

The greatest asset of a small plant is its ability to give quick action. A small organization with definite responsibilities eliminates the necessity of a tedious checking of departmental and company policies and obtaining of O.K.'s. A small plant may concentrate on one specialty and know its subject well and it may impress its customer on that account better than many a large industry with so-called diversification where replies are slow, understanding difficult and deliveries drag.

The small plant can be alert to have the best machinery equipment and the best research equipment and staff. It is wrong to assume that the great industry has unlimited resources in this regard. The great industry is so big and the demands upon it are so complicated that it is frequently out of date with machinery, and its research on any given subject is retarded by the complexity of the many demands upon its research staff.

The laws of mathematics are all against big industry in the matter of internal success. Many executives make many complications and many jealousies, much lost motion and much delay. Small industry too can complicate itself and load itself down with barnacles.

When a good industry survives, it finds its most severe competition from an industry that did not survive, but went into receivership and was bought up at less than fifty cents on the dollar, started up with less overhead and renewed price cutting.

Other factors favoring the small industry were brought out by F. M. Feiker, Director of the U. S. Bureau of Foreign and Domestic Commerce. In part, he said:

With an increasing density of population in this country it is becoming less and less necessary to cover the whole United States market in order to enable a concern to have a sufficient volume of business to be of efficient productive size. This means that the smaller plant will be at an increasing advantage with respect to its own locality, in which it can concentrate its business at great savings in distribution as well as manufacturing.

Some of the major advantages of large scale organization in the fields of marketing and of industrial research are no longer exclusively available to the giant concern. Tremendous strides have been made recently in the development of active and effective trade associations, which enable the smaller manufacturers to handle cooperatively their common problems and projects which are too large for them to deal with individually. There is an increasing tendency for smaller concerns to co-operate in this field and obtain many of the advantages of large-scale action with a minimum of overhead expense to support it.

Most important in the group of reasons found by the bureau to account for current success of industry were increased sales effort and advertising policies, and then, in the order of the number reported, came market research, reduced prices, co-operation with dealers, improvement of service and the management of salesmen.

There are, it seems to me, four forces that are natural allies in pushing forward the new frontiers of trade. We have allied in common movement for the improvement of business practice first the educational institutions, which each year turn out young men with an increasing sense of professional sides of business. We have, second, in the trade and technical associations a fabric of tremendous social and economic importance as a part of the educational machinery for improving business practice and developing business policy. We have, third, in the business press, as distinct from the public press, a vehicle for the interchange of ideas as to methods and practices on highly specialized commodity and service lines. And, fourth, we have in the relation of government bureaus, like the Bureau of Foreign and Domestic Commerce, the Bureau of Standards, the Bureau of Mines, and other functional divisions of the Department of Commerce, vast resources established to aid and improve business practice in the interest of both business and the public.

This Week

Roosevelt skirmishes with Hoover on power treaty. p. 67

Organizing to find and cut system losses. p. 76

Depression no excuse for delayed hydro license. p. 67

Growing Philadelphia load necessitates new turbine. p. 71

Long puts Commissioner Garsaud under fire. p. 66

Promotional rates must have small initial block. p. 81

Better engineering needed for primary service vaults. p. 91

We hear much discussion of the cost of these various enterprises. Trade associations are under the scrutiny of membership from the viewpoint of expense; colleges and institutions and schools are suffering from lack of income; the functional relation of the business press is hindered by reduced income, and the drive continues on governmental economy.

I see no hope for such conceptions as national planning, the development of social responsibility of business, the acceptance of the idea of partnership between business and government, except through the slow process of education, and in this process of education the schools and universities, with trade and technical organizations, the business press and the government departments which touch industry and trade, all have a common opportunity and a common challenge.

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Garsaud and Mates "Too Friendly to Power"

Opposition to Marcel Garsaud as a member of the Federal Power Commission was expressed at a recent hearing before the Senate Interstate Commerce Committee by Senator Long (Dem.) of Louisiana. Also opposition to the nomination of Judson King, director of the People's Popular Government League, was heard.

Senator Long asserted that the commission "has operated almost as a back door to the Electric Bond & Share Company" and that it "has been a quit-claim agency" for this company.

Mr. King declared before the committee that three members of the Federal Power Commission are "too friendly to private power interests," namely, Chairman George Otis Smith, Ralph D. Williamson and Mr. Garsaud.

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Federal Board Scents "Fleecing" in New River Scheme

Effort of the Appalachian Electric Power Company to proceed under the Virginia law in developing the New River hydro project is combated by a brief which the Federal Power Commission has filed in the Federal District Court at Lynchburg. Previously the commission had considered the company was exempt from the provisions of the state law, but application by the company to function under that law hurries the federal board into a counter action. The old issue whether a site some 155 miles above navigation comes under the jurisdiction is still prominent in the case, but the new angle is the attempt of federal agency to preserve its broad authority to safeguard public interest.

It senses a duty to keep such a project "free from the entanglement of debts for purposes not of benefit to the project" and its perversion "as a means of fleecing the public by overissues of stocks and bonds or creating the semblance of claims on behalf of investors which might impede the return of the project into government control." The commissioners are sued as individuals and the brief prays the dismissal of the suits calling for annulment of the intent of the commission to ignore the non-navigability of the stream and at the same time over-ride the rights and desires of the contiguous states.

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Ainey Before Pinchot Denies Graft Charges

Formal denial that he had received any money from the late Thomas E. Mitten, as charged by A. A. Chapman, was made in a public hearing on Monday by Chairman W. D. B. Ainey of the Pennsylvania Public Service Commission. As a counter charge he asserted he was informed that Chapman had first demanded $50,000 of the Philadelphia Rapid Transit Company as the price of silence on the charges, later offering to accept $20,000.

Chairman Ainey told Governor Pinchot that canceled checks for $24,000 in Chapman's possession did not cover payments by Mitten or the transit company to him and that he had never met Mitten in a New York hotel as charged by his accuser nor were his massage treatments paid for by any one but himself. Mr. Ainey testified from his wheel chair.

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Pressure for Sympathetic Reduction Spreads

Rate reductions in sympathy with commodity indices and reduced consumer purchasing power are being asked for in a widening circle of communities. Thus a resolution requesting the Consolidated Gas, Electric Light & Power Company of Baltimore to make a voluntary reduction in its rates has been introduced in the Baltimore City Council. The Chesapeake & Potomac Telephone Company also is included in the resolution.

The companies are requested to make voluntary reductions in their rates "so as to place such rates on a par with the existing prices of other commodities and services, in so far as practicable." For the same reason reduction of electric light and power rates was asked at a meeting held in East Point, Ga. This meeting was the second in a series being held in the state.

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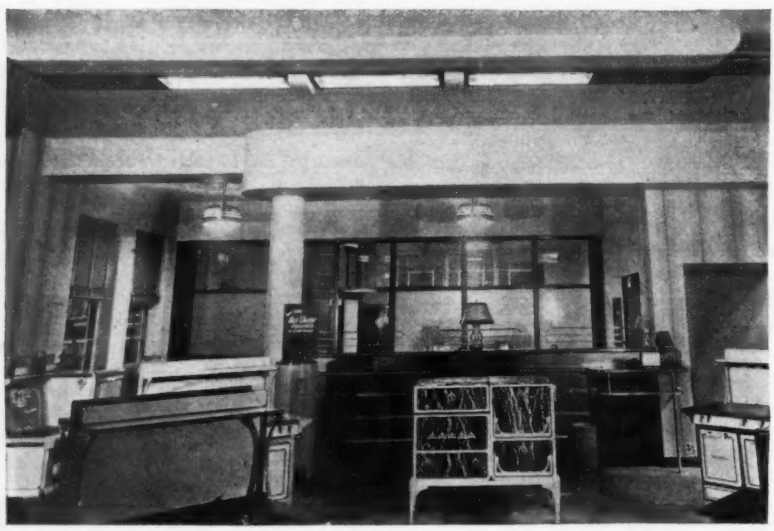
Gaseous-Discharge Lamps Used Exclusively in Store Lighting



Said to be the first commercial structure in this country to be lighted exclusively by gaseous-discharge lamps the Ilion, N. Y., office and store of the Utica Gas & Electric Company has recently been opened. Exterior signs and decorative pilasters, show windows, demonstration kitchen, store and service office interiors all are lighted with this type of equipment. "Suneon" units were adopted. These tubes operate on 110-220 volts and give an intense light. The reds are said to be 8 to 10 times more brilliant and the blues and greens 3 to 4 times brighter than in the usual form of gaseous lamp.

Red, blue and green tubes have been merged to yield an illumination approximating north sky daylight. "Suneon" also features controlled ultraviolet radiation down to 2,850 angstroms. Rated at 800 to 850 watts, the units yield 17 to 20 lumens per watt and, mounted 20 ft. high and spaced 20 ft. apart symmetrically, give an average initial intensity of more than 25 foot-candles on the working plane, with a minimum life of 3,000 hours.

Hoover Tells Roosevelt No Parley Necessary

Signing of a treaty with Canada in connection with the development of power on the St. Lawrence appears to be imminent and this was taken as a signal by Governor Roosevelt to cast the issue prominently into the campaign for the Presidency. Informed by his State Power Authority that substantial accord had been reached with the State Department on all points except the amount of New York's share in the cost of the project, the Governor on Saturday asked President Hoover for the privilege of a conference to discuss this angle. The President on Sunday advised his Democratic opponent that negotiations with the Canadian government had reached the stage where it would not be necessary for the Governor to interrupt his contemplated cruise for the sake of a conference.

The matter of contention is whether the amount of New York's commitment will be fixed by the treaty or whether it shall remain an item of domestic adjustment after the conclusion of the treaty. The New York Governor is reported to fear that Canada's insistence on two dams will make the cost to New York so high as to weaken the competitive position of the state with respect to privately produced power. The President, however, in no uncertain terms informed the Governor that the proposed treaty does not make the disposal of domestic division of costs a matter of international agreement.

In the interchange of messages is seen by many commentators the Presidential aspirant's opening gun of a barrage on the power policies of Mr. Hoover and the Republican administration. Meanwhile, sentiment in Canada appears to favor a prompt conclusion of the international agreement now that the resolution of differences between Ottawa and Quebec has largely removed the latter's stern objection.

Business Factors a Shade More on Favorable Side

OPTIMISTS will have found several rosy rifts in the economic clouds during the past week. European gentlemen agreed at Lausanne to cut German reparations to a new low, hoping we will cancel allied debts later. That hope is father to an unlikely thought. But the general sentiment encourages long-range hopefulness.

Garner's bunted relief bill is sensed as a sacrifice hit as Hoover bags it and makes a double play in addition. Uncle Sam now will not have to be a pawnbroker.

Of greater immediate meaning is the rise in hog prices and the farmers' consequent jubilation. Maybe the plateaus now held for several weeks by commodity indices and security prices also mean something. Bonds hold gains, while some stocks, nevertheless, make new lows.

But don't forget steel is at 12 per cent and car loadings are dismal, even though Pennsy and Central report slight gains.

Telephone disconnections, largely commercial, reached 225,000 in June, raising the question whether that field has not been oversaturated.

New Englanders Grapple with Industry Problems

VIGOROUS policies designed to build up domestic business and to hold industrial patronage against economic competition in difficult times featured the proceedings of the 24th annual convention of the New England Division of the National Electric Light Association, which was held this week at Bretton Woods, N. H.

An outstanding paper on Diesel engine competition by H. C. Thuerk depicted the growing menace of this prime mover to power sales in smaller industrial plants. Improvements in design and sales through trial installations make Diesels a formidable competitor, although many unsettled questions remain to be capitalized by utility engineers in discussing purchased power with industrial customers.

Cost data are still incomplete and uncertain in many proposed applications. Much remains to be learned as to the life expectation of the lighter engines of recent design; maintenance, while reduced, still requires the services of trained operating engineers, and the tendency of industrial plants to demand quick retirement of capital outlays warrants careful consideration of the equipment policies of executives often far removed from operating departments. Overestimates of energy consumption also tend to leave the engine plant unpaid for at the end of expected periods. Constant and systematic contacts between industrial customers and power salesmen are vitally important in this coming era.

R. B. Brown, Jr., depicted the load-building opportunities offered by residence lighting, declaring that one-third of the present home fixtures are obsolete and that two-thirds of American kitchens are poorly lighted. He commended home-planning lecture demonstrations and cited the co-operation of department stores in this activity. John W. Scott stressed the need of industry co-operation and unification of merchandising policies on a state-wide basis and George N. Brown, N.E.L.A. refrigeration manager, outlined the progress of this year's sales campaign. At the present rate 850,000 units will be sold, and to July 1, 540,000 household machines have been marketed. D. M. DeBard predicted proportional success in the electric range campaign.

W. C. Bell, retiring president, stressed the importance of renewed sales activity in the face of limited possibilities of further drastic economy in operation and President W. A. Buttrick voiced the sympathetic support of progressive executives in constructive load building, especially in the domestic field.

B. F. Weadock, executive director N.E.L.A., declared that "the industry's problems must be solved in Main Street and not on Wall Street or Pennsylvania Avenue." He welcomed honest criticism of the industry, stressed the local characteristics of its business and set forth the purposes of the reorganized N.E.L.A. from the trade association standpoint. He closed with a strong plea for fair treatment of the power industry in the face of its achievements and honorable record.

Further Delay Denied on Missouri Hydro Project

Current economic conditions confer on the Federal Power Commission no authority to grant further delay in issuing a license for a $16,000,000 hydro project on the White River at Table Rock, Mo. The original application had been made December 31, 1925, and it was the opinion of the commission that Congress intended to limit definitely to seven years the period during which the issue of the license could be delayed. Holding, therefore, to the date of December 1, 1932, previously fixed for the applicant, the Empire District Electric Company, to accept the license there would still elapse five years more before the completion of the project would have to be effected, and this the commission believes long enough to outlive the present deterrents.

Low demand for power in the territory and high current cost of financing were cited by the applicants as grounds for further delay and the commission acknowledged the facts and their significant bearing on the practicability of the project. Nevertheless, the inconvenience to the communities from further procrastination of the execution of agreements for reimbursements to the public agencies for relocation of highways, bridges, etc., is believed by the board to have influenced Congress in fixing a definite term which the board feels it was granted no discretion to extend any further.

Coming Meetings

Camp Co-operation XII—By boat to Bermuda, Aug. 3-8. Society for Electrical Development, 420 Lexington Ave., New York.

Wisconsin Utilities Association—Commercial section, Eau Claire, Wisc., Aug. 25-26. John N. Cadby, 135 W. Wells St., Milwaukee, Wisc.

American Institute of Electrical Engineers—Pacific Coast convention, Vancouver, B. C., Aug. 30-Sept. 2. Middle Eastern District Meeting, Baltimore, Md. Oct. 10-13. H. M. Henline, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-9. H. A. Buch, Telegraph Bldg., Harrisburg.

Rocky Mountain Division, N.E.L.A.—Stanley Hotel, Estes Park, Colo., Sept. 12-14. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Empire State Gas & Electric Association—Saranac Inn, N. Y., Sept. 22 and 23. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Oct. 6-8. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists, International—Kansas City, Mo., Oct. 10-12. L. W. Davis, 420 Lexington Ave., New York.

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American & Foreign Power Bank Loan Extended

In financial statements mailed to stockholders American & Foreign Power Company disclosed that in April contracts were made giving the company the right to extend to October 26, 1933, the maturity date of the $50,000,000 of bank loans due October 26, 1932. Moreover, $30,000,000 borrowed from the parent company, Electric Bond & Share, during 1931 and an additional $5,000,000 more recently borrowed, was funded during April by the issuance to Electric Bond & Share of the American & Foreign Power Company's note in the amount of $35,000,000. This note falls due on April 15, 1934, and bears interest at the rate of 7 per cent.

The recent decline in the revenues of the American & Foreign Power is not an accurate measure of the actual business done by the company's subsidiaries in the countries in which they operate. The problem of foreign currencies has been an important factor in the company's earnings. Depreciation in gold exchange equivalent of certain foreign currencies has had an increasingly adverse effect. In Argentina, Brazil, Chile, Colombia, Costa Rica and Ecuador this depreciation in gold exchange equivalent of their national currencies is being accompanied by the imposition of restrictions on foreign exchange operations, with the result that some of the company's subsidiaries cannot remit in gold equivalent as much of the proceeds of their collections from customers as is required to meet their obligations in United States and other foreign currencies.

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Plan to Retrieve Rochester from Associated

Local bankers and business men moved today to regain control of the Rochester Gas & Electric Corporation, which has been part of the Associated Gas & Electric system for the last three years.

Application was filed with the Public Service Commission at Albany for authority to form a ten-year voting trust. The Rochester group and New York bankers have agreed to co-operate with the Associated in refunding $9,700,000 in 3 per cent notes of the Rochester corporation due July 15.

A local board of directors for the Rochester corporation, including ten Rochester men and five Associated representatives, is contemplated.

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Utility Maturities Heavy in July

UTILITY maturities in 1932 aggregated $507,354,490, of which $151,107,100 fell due in the first half of the year and $356,247,390 falls due in the last half of the year. Thus about 71 per cent of the aggregate is coming due in the near future. In addition to these maturities there is a large total of bank loans outstanding, many of which mature this year.

Out of 39 issues of $1,000,000 or more in the first half of the year 27 were paid off in cash, six were defaulted and six were extended or exchanged for bonds in later maturity. The outlook for the second half is not encouraging for refunding operations. Capital markets are virtually closed to all but the highest grade borrowers and the contemplated legislative relief measures do not offer hopes for refunding credits. Thus exchange offers, cash pay-off and a minor amount of refunding are the only available methods for meeting the forthcoming maturities.

Even the best operating properties find difficulty in financing maturities. For example, Lowell Gas Light Company earned interest charges 7.02 times in the twelve months ended April 30, 1932, but was unable to finance $1,500,000 of 3 per cent notes even with new 5 per cents and small cash payments.

Big maturities in July

Insull operating companies have large maturities on July 15. Commonwealth Edison proposes to issue $18,000,000 first mortgage 5½ per cent 30-year bonds, People's Gas $20,000,000 first and refunding 5½s, due in 25 years, and Public Service of Northern Illinois $32,000,000 first lien and refunding 6½s, due in twenty years. A syndicate is being formed to market these issues.

Edison Electric Illuminating Company of Boston has $20,000,000 4½s coming due October 1, $20,000,000 4s November 1 and $30,000,000 5s due January 15, 1933. This company has an enviable earning record and has already sold $10,000,000 one-year 4½s and $20,000,000 three-year 5s to provide in part for the coming maturities. This week the company placed on the market another issue of 5 per cent notes, priced at 99.62 and totaling $250,000,000.

New England Power Association has $20,000,000 Grafton Power Company bonds in its treasury which it hopes to sell to meet $20,000,000 5s due December 1. Rochester Gas & Electric has $10,000,000 one-year 3 per cent notes due July 15 for which it is reported payment has been provided.

The Associated Gas & Electric Company has asked its security holders to invest "small amounts" to meet an $18,556,000 maturity.

Thus the use of cash reserves, short-time notes, refunding bonds and other methods are followed, depending upon conditions. One aspect of the heavy maturity situation has been to hold capital expenditures on properties to a minimum. A favorable security market would result in a quick response in industry purchasing power and expansion programs.

The following tabulation gives by months maturities of more than $1,000,000 over the balance of this year:

Date	Issue	Rate	Amount
July 15	Roch G. & E. 1-yr.....	3	$10,000,000
July 15	Saxon Pub. Wks 2-yr....	5	10,000,000
July 30	Com'w'lth Ed. 1-yr.....	3½	20,000,000
July 30	People's Gas 1-yr.....	3½	15,000,000
July 30	Pub. Serv. No. Ill. 1-yr.	4	15,000,000
July 31	Scrant. Spr. Br. W. Serv. 1-yr.....	4	1,500,000
Aug. 1	Bklyn-Manh. Tr. 3-yr..	6½	$13,500,000
Aug. 1	Pub. Serv. No. Ill. deb..	5	10,000,000
Aug. 1	Penn Elec. 1-yr.....	3½	9,000,000
Aug. 1	West End St. Ry. deb...	4	5,709,000
Aug. 1	Cent. W. Pub. Ser. 3-yr.	7	1,000,000
Aug. 1	New Milford Pwr. 1st...	5	1,000,000
Aug. 15	Gen. G. & E. serial.....	5	2,950,000
Sept. 1	Int. Rap. Trans. cv.....	7	$32,232,000
Sept. 1	Iowa Ry. & Lt. ref.....	5	6,572,000
Sept. 1	Iowa Ry. & Lt. ref.....	8	1,000,000
Sept. 1	Union El. Lt. & Pwr. 1st	5	6,200,000
Sept. 1	Houston Gas & F. ref...	5	4,587,000
Sept. 1	Indiana El. 1-yr.....	4½	2,500,000
Sept. 1	Col. Springs & Int. 1st..	5	1,450,000
Oct. 1	Ed. El. Ill. of Bost. 1-yr	4½	$20,000,000
Oct. 1	Int. Rap. Trans. notes..	6	10,500,000
Oct. 1	New Eng. Tel. deb.....	5	10,000,000
Oct. 1	Wichita R.R. & Lt. cons	5	1,493,000
Oct. 1	Birmingham Gas 1-yr...	4½	1,250,000
Nov. 1	Ed. El. Ill. of Bost. 2-yr	4	$20,000,000
Nov. 1	Scranton Ry. cons.....	5	1,100,000
Nov. 1	Scranton Trac. 1st.....	6	1,000,000
Nov. 15	Western Util. 1½-yr.....	5½	2,500,000
Dec. 1	Toledo Lt. & Pwr. 2-yr..	5	$35,000,000
Dec. 1	New Eng. Pwr. Asso. 2-yr.....	5	20,000,000
Dec. 1	North Bost. Ltg. 1-yr...	5½	7,500,000
Dec. 1	San Diego Cons G. & E. 1-yr.....	4½	1,500,000
Dec. 1	Ala. Wat. Ser. 2-yr.....	5	1,000,000
Dec. 15	Scrant. Spr. Br. Water..	4½	1,000,000

Current Earnings Reports of Electric Light and Power Companies

OPERATING COMPANIES

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Consolidated Gas, Elec. Lt. & Pwr. Co. of Baltimore (5 mos. ended May 31)					
Gross earnings	$12,252,793	$12,623,831	— 2.9	66	66
Net earnings	4,128,758	4,272,661	— 3.4	..	..
Net profit	2,581,148	2,908,471	—11.2	..	..
Duquesne Light (Year ended May 31)					
Gross earnings	26,793,089	28,596,488	— 6.3	42	44
Net earnings	15,453,451	16,184,594	— 4.5	..	..
Net profit	11,823,427	13,134,167	— 9.0	..	..
Kansas City Power & Light (Year ended May 31)					
Gross earnings	14,687,092	14,814,915	— 0.8	59	60
Net earnings	6,020,016	5,766,314	4.4	..	..
Net profit	4,194,704	3,978,850	5.4	..	..
Louisville Gas & Electric (Year ended May 31)					
Gross earnings	10,229,360	10,792,275	— 5.2	54	55
Net earnings	4,633,719	4,901,569	— 5.4	..	..
Net profit	2,000,344	2,263,273	—11.6	..	..
Northern States Power (Del.) (Year ended May 31)					
Gross earnings	33,600,773	33,611,312	— 0.0	57	58
Net earnings	14,380,900	14,240,716	0.9	..	..
Net profit	3,548,029	3,795,878	— 6.5	..	..
Southern California Edison* (Year ended May 31)					
Gross earnings	39,442,599	41,489,564	— 5.0	32	31
Net earnings	26,901,898	28,463,096	— 5.0	..	..
Net profit	12,824,212	14,399,655	—11.0	..	..

HOLDING COMPANIES

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American & Foreign Power & subs. (Year ended March 31)					
Gross earnings	62,010,147	76,410,288	—18.9	55	54
Net earnings	27,631,924	35,311,148	—21.7	..	..
Net profit	22,071,650	29,872,044	—26.1	..	..
American Power & Light & subs. (Year ended April 30)					
Gross earnings	80,726,211	85,895,599	— 6.2	52	55
Net earnings	38,366,607	38,949,684	— 1.5	..	..
Net profit	16,302,397	18,606,400	—12.3	..	..
American Water Works & Electric & subs. (Year ended May 31)					
Gross earnings	$47,554,252	$52,567,137	— 9.5	56	58
Net earnings	21,011,100	21,810,433	— 3.7	..	..
Net profit	4,167,060	4,877,827	—14.5	..	..
Associated Gas & Electric & subs. (Year ended May 31)					
Gross earnings	103,155,573	105,613,752	— 2.0	65	60
Net earnings	36,425,507	41,966,733	—13.0	..	..
Net profit	Not given	Not given			
Commonwealth & Southern & subs. (Year ended May 31)					
Gross earnings	124,366,522	136,381,132	— 8.8	53	55
Net earnings	58,049,130	61,517,557	— 5.6	..	..
Net profit	10,255,464	17,581,284	—41.7	..	..
Electric Power & Light & subs. (Year ended April 30)					
Gross earnings	77,308,323	82,601,004	— 6.4	56	57
Net earnings	34,081,272	35,375,629	— 3.7	..	..
Net profit	10,751,548	12,858,445	—46.3	..	..
Federal Light & Traction & subs. (Year ended May 31)					
Gross earnings	7,856,965	8,337,816	— 5.8	63	63
Net earnings	2,930,092	3,106,933	— 5.7	..	..
Net profit†	1,478,692	1,622,992	— 8.9	..	..
National Power & Light & subs. (Year ended April 30)					
Gross earnings	75,898,098	79,178,155	— 4.1	60	62
Net earnings	30,392,012	29,912,462	1.6	..	..
Net profit	11,701,114	12,467,484	— 6.2	..	..
Philadelphia Company & subs. (Year ended May 31)					
Gross earnings	52,199,493	59,853,715	—12.8	64	61
Net earnings	18,829,319	23,287,251	—19.2	..	..
Net profit	7,847,778	12,296,023	—36.1	..	..
Public Service Corporation of New Jersey & subs. (Year ended May 31)					
Gross earnings	133,145,319	139,276,209	— 4.4	66	68
Net earnings	44,757,490	44,887,493	— 0.9	..	..
Net profit†	30,393,511	31,365,334	— 3.1	..	..

Gross earnings — Gross operating revenue. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net profit — Balance available from income for common stock dividends.

*Operating expenses do not include depreciation.

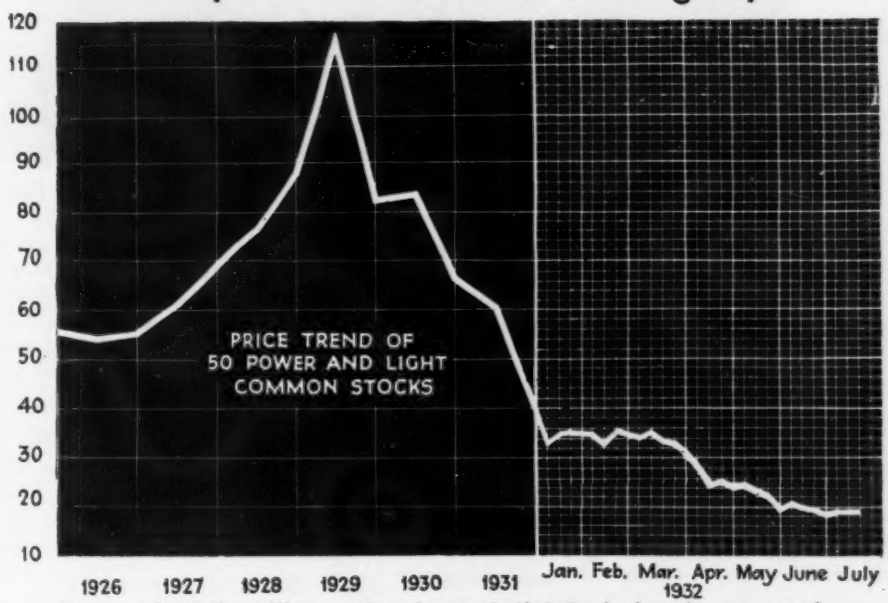
†Balance available for preferred and common dividends.

Pacific Gas to Acquire Pacific Public Service

The Pacific Gas & Electric Company will purchase the Pacific Public Service Company, $32,000,000 Standard Oil Company of California subsidiary, subject to the approval of the State Railroad Commission. Negotiations have been pending for some time, but since Pacific Gas fundamentally was interested only in one Pacific Public Service property, the Coast Counties Gas & Electric Company, it was questionable just what would be done with the other subsidiaries. However, it is understood Pacific Public Service properties will be taken over in their entirety.

The purchase is conditional upon an offer by Pacific Gas to holders of first preferred and non-voting common stocks at the ratio of forty-five-hundredths of a share of Pacific Gas common for each share of Pacific Public Service first preferred and one-fifteenth of a share of Pacific Gas common for one share of Pacific Public Service non-voting common. The offer is to be effective as of October 1, 1932, for the first preferred and as of July 1, 1933, for the common stock. While no mention was made of the price to be paid for the second preferred and voting common stocks, owned 90 per cent by Standard Oil and 10 per cent by Pacific Lighting, it is understood that favorable offers have been made to both companies.

Utility Stocks Advance Slightly



Prices of public utility stocks advanced slightly during the past week, several issues recovering some of the ground lost during the preceding weeks. The "Electrical World" index moved upward to 19.1, as compared with 18.8 during the preceding week.

Ontario Hydro Reports Sustained Operations

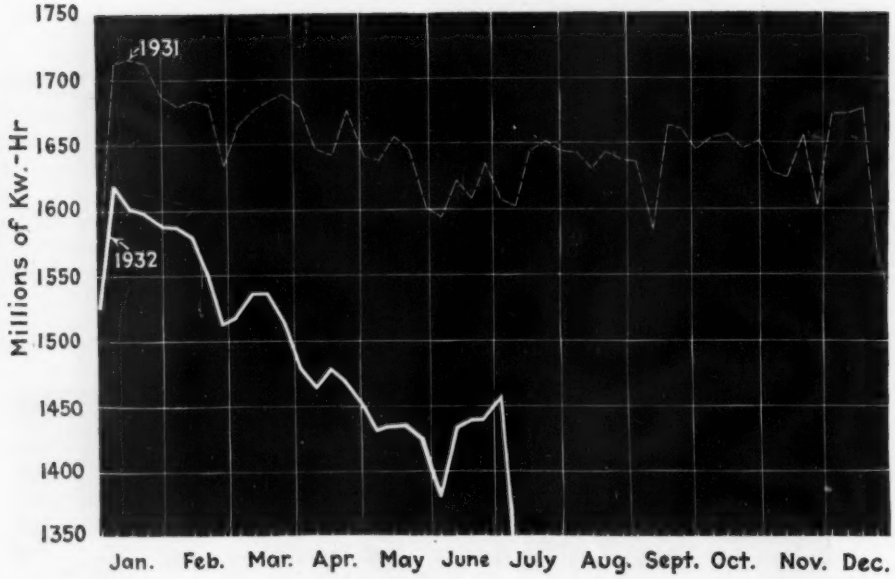
Despite the period of depression through which Ontario, in common with the rest of the world, is passing, the Ontario Hydro-Electric Power Commission sold approximately as much power in 1931 as in the preceding year, according to the annual report just published.

The number of municipalities served by the commission during the year was 721. Aggregate reserves of the commission amounted to $115,639,726 in 1931, as compared with $103,857,682 in the previous year. Of this total, $53,235,314 relates to the properties owned and financed by the individual municipal utilities, in which they have a capital investment of $105,434,582. The sum of $62,404,412 constitutes the reserves accumulated by the commission on behalf of the municipalities in connection with the commission's investment of $267,575,540 in the collective properties that are financed through direct advances and guarantees by the province.

In 1921 total assets were shown at $40,112,000, while last year the assets had grown to $125,538,000. Total liabilities in 1921 were $25,434,000, while in 1931 they were $52,199,000.

Of the total kilowatt-hours sold for domestic service, more than 86 per cent is sold in municipalities where the average charge to consumers, inclusive of all charges, is 1.9 cents or less per kilowatt-hour, the report says. Similarly, for commercial light service, more than 91 per cent is sold in municipalities where the average charge to consumers for this service is 2.4 cents per kilowatt-hour or less. For retail power service supplied by the municipal utilities 53 per cent is sold in municipalities where the average charge to consumers is $20 or less per horsepower per year and less than 4 per cent of the power service supplied by municipalities was sold where the average cost exceeded $20 per horsepower per year.

Holiday Cuts Output



AFFECTED chiefly by the holiday, the output of central stations for the week ended July 9 fell to 1,341,730,000 kw.-hr. from 1,456,961,000 kw.-hr. in the preceding week, after an upward trend in May and June.

Because Independence Day did not fall in the corresponding week last year the two-weeks average must be used for a valid comparison with 1931. This indicates a decrease of 12.8 per cent, which is about 1 per cent greater than in the last preceding week.

The decline appears to have been confined to the Pacific Coast, and may therefore have been due to conditions peculiar to that part of the country—for example, the use of less energy this year for irrigation pumping. In the chief industrial regions no such downward turn is indicated. The percentages compared with 1931 are almost identical with those of the week ended June 25. Operations in the Central area continue to fall about 15 per cent short of last year's.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
July 9	1,342	1,604	1,626	1,712
July 2	1,457	1,607	1,594	1,592
June 25	1,441	1,635	1,704	1,723
June 18	1,442	1,610	1,698	1,703
June 11	1,435	1,621	1,707	1,699

Per Cent Change from 1931

Region	2 Wks. July 9	Week Ended July 2	Week Ended June 25
Atlantic Seaboard	—9.4	.....	— 9.5
New England alone	—10.2	.....	—10.8
Central industrial	—14.8	.....	—14.2
Pacific Coast	—13.9	.....	— 9.6
United States	—12.8	.....	—11.9

May Output Down 13 Per Cent; Revenue 7

As was foreshadowed in the weekly estimates of the National Electric Light Association, the output of electric public utility power plants in May took a further drop from that of the corresponding month last year. According to a report by the United States Geological Survey the production of all plants generating energy for public use in the United States in May was 6,628,893,000 kw.-hr., a decrease of 13 per cent compared with 1931. The revised figure for April is 6,782,199,000 kw.-hr., down 11 per cent from 1931.

These quantities include production by electric railway and railroad plants for traction, Bureau of Reclamation, public works plants and that part of the output of manufacturing plants which is sold for public use, as well as of central stations for light and power.

The average daily production, 213,800,000 kw.-hr., was about 5 per cent less than in April; the normal change from April to May, based on 12 years of records, is a decrease of 1.5 per cent.

Water power again contributed an unusually large share of the total, nearly 46 per cent, or about the same as in April. That the shrinkage compared with 1931 was general, but particularly affected New England, the Western mining states, the Southeast and the industrial Middle West, is evident from the following table, which gives the change, by geographical divisions, for April and May:

Region	April	May
New England	—10	—18
Middle Atlantic	—8	—10
East North Central	—15	—15
West North Central	—8	—8
South Atlantic	—10	—15
East South Central	—13	—15
West South Central	—10	—12
Mountain	—24	—29
Pacific	—12	—10

Decrease in revenue

In contrast with the relatively large decline in output, the revenue of companies for which reports have thus far been received by the ELECTRICAL WORLD is down only 7 per cent. Since these are typical companies, comprising more than half the electric light and power industry, it is estimated that May earnings were about $159,000,000, against $171,550,000 a year ago.

As in the case of energy output, the decrease in revenue appears in each geographical division, ranging from 12 per cent in the West South Central and 11 per cent in the East North Central to 4 per cent in the South Atlantic. Along the North Atlantic seaboard the average decrease was about 6 per cent. In general, the differences are somewhat greater than those for April, published in the issue of July 2.

Thiokol Company Licenses General Cable Corporation

Use of the new protective material known as "Thiokol" for electrical purposes has been taken up by the General Cable Corporation under a licensing agreement with the Thiokol Corporation. Extensive tests over a two-year period have demonstrated that a jacket of proper Thiokol compound over rubber is superior to the rubber itself in resistance to chemical action, fatigue, sunlight, oil, vibration and corona. It also has advantages as cable sheathing.

Development work is already in progress to complete the adaptation of the new material to power cables, overhead conductors and secondary network conductors. It will also be employed for wires put to general industrial uses where rubber is subjected to the deleterious influence of oil, acid, weather or light. We understand the field at this time is limited to 600 volts.

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Hoover Dam Pipe Ordered

The Babcock & Wilcox Company has been awarded the contract for fabricating the 30-foot diameter steel pipe for the four pressure tunnels at the Hoover Dam on the Colorado River. This lowest bid was for $10,908,000. The only other bidder was the A. O. Smith Company of Milwaukee, whose bid was $11,697,284.

The steel must be transported in sheets and a fabricating plant capable of making the pipe established at the site. It probably will take five years to terminate the pipe construction.

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Philadelphia Turbine Order Offers Employment Relief

Simultaneously with announcing the placing of an order for a 165,000-kw. turbo-generator with the Westinghouse Electric & Manufacturing Company, President W. H. Taylor, of the Philadelphia Electric Company, discussed the contribution it would make to economic relief in the Philadelphia area. In explaining the need for additional capacity he said:

During the depression period we have not only retained virtually all of our customers but have added additional load —as, for example, the electrified loads of the Pennsylvania and the Reading Railroads. As all of this now-attached load begins to approach normal operation, the demands on our capacity will require largely increased facilities.

We look to the future with optimism, confident that business will return to normalcy within a reasonable time, and our policy of expansion gives expression to that confidence and belief.

The contract involves an outlay of $8,500,000 during the next two years. Employment for about 100 men will result in a few months in connection with the preliminaries at Richmond station. This staff will increase to 800 early in 1934 as the date of scheduled operation, November 1, 1934, approaches. The Westinghouse company estimates it will involve 349,000 man-hours of labor at the South Philadelphia works to produce this machine and its accessories. It is to be a tandem-compound unit, single generator and double-flow design of the low pressure end.

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Farm Electrification Made Great Gain in 1931

Rural electrification recorded a gain of 90,800 in number of farms in 1931, the greatest for any one year to date, S. H. McCrory, Chief of the Bureau of Agricultural Engineering, points out in a statement just made public by the Department of Agriculture.

About 1,000,000 farms now have electricty, Mr. McCrory said, and of these, 644,500, or nearly 10 per cent of all farms in the United States, have service from high-tension lines. It is estimated that 60 to 80 per cent of California farms have electricity, he said. The estimated number of independent or unit farm-lighting plants is between 300,000 and 400,000.

As the farmers have learned the value of electricity, the consumption has likewise increased. During 1930 farmers bought 1,779,000,000 kw.-hr. of electrical energy at a cost of $46,187,000, according to a recent report of the power industries.

Among the more recent uses of electrical energy is the heating of soils and hotbeds. Some experimental work in these lines has been conducted by several agricultural experiment stations, with promising results.

In this use of electricity Norwegian and Swedish engineers were the pioneers. Electricity has been found particularly useful in operating equipment for dehydrating crops where close regulation of temperatures must be maintained. Sweden has thousands of electrically operated threshing rigs.

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Czechs Use U. S. Sales Methods

American methods of energy sales and appliance sales promotion are closely followed in the practice of the municipal electric plant at Prague, Czechoslovakia. The appliance manufacturer is aided in marketing his product and a retail shop and lecture demonstration room help tell the Czechs what the rest of the world does with electricity in its households.

Major New Construction This Week

PLANS authorized by Mountain States Power Company, Tacoma, Wash., for hydro-electric power plant near Stayton, Ore., to cost close to $100,000, with power dam and transmission lines. Unit will replace station destroyed by fire a number of months ago. Site and water rights secured.

Machine drives, motors, controls, conveyors and other electrical equipment will be installed in new $50,000 corrugated paper products plant at Mount Wolf, Pa., to be constructed by Superior Paper Products Company, Carnegie, Pa.

Bids asked until August 16 by Construction Service, Veterans' Bureau, Washington, D. C., for electric power equipment, including electric refrigerating and ice-making plant, electric elevators, motor-driven ventilating equipment, electrical distribution system and other work at institution at Cheyenne, Wyo.

Motors, controls, conveyors and other electric power equipment will be installed in two additions to be built at mill of American Net & Twine Company, Blue Mountain, Ala., estimated to cost $65,000. Work authorized.

Expansion program has been authorized by Philadelphia Electric Company, Philadelphia, Pa., at Richmond generating station on Delaware River, including installation of 165,000-kw. turbo-generator unit and auxiliary equipment, with new transformer and switching station, transmission line construction and power substations. Prime mover ordered of Westinghouse. Orders for miscellaneous equipment still to be placed.

Motors, controls, conveying and other electrical equipment will be installed in multi-story addition to plant of American Paint Works, Inc., New Orleans, La. Cost about $80,000.

General Electric Builds Oil Burners

A new oil burner, the result of long search by General Electric engineers to find a home-heating plant that would offer all the convenience of automatic oil heating and at the same time be sufficiently inexpensive in initial cost and operating cost, is now in production. It marks the advent of the General Electric Company into this field.

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New York Metal Prices

	July 6, 1932 Cents per Pound	July 13, 1932 Cents per Pound
Copper, electrolytic	5.375	5.25
Lead, Am. S. & R. price	2.75–2.85	2.70
Antimony	5.00	5.00
Nickel, ingot	35.00	35.00
Zinc, spots	2.95	2.90
Tin, Straits	20.875	21.00
Aluminum, 99 per cent.	23.30	23.30

American Superpower Buys Own Stock

The American Superpower Corporation has advised stockholders of a plan to purchase and retire up to 75,000 shares of its first preferred stock at $40 a share, if that much stock is offered to it. In the last month the stock has been selling in the open market at $28 to $37.50 a share. The offer will be open until the close of business on July 20. The stock was offered originally in May, 1925, at $95 a share.

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Would Eliminate Commission

Seventeen members of the Indiana General Assembly and Lieutenant-Governor Edgar D. Bush are committed to some type of utility reform legislation, according to lists in the offices of the Municipal Rights League of Indiana. The league in general hopes to eliminate the Indiana Public Service Commission and thus permit the establishment of municipally owned utilities in competition with privately owned utilities.

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Canadian Plant Makes New High Record

The Grand Falls hydro-electric plant of the St. John River Power Company, a subsidiary of the Gatineau Power Company, has made a new high output record for a single day by producing 1,368,000 kw.-hr. of electric energy. The previous high mark was established last December, when the plant generated 1,353,000 kw.-hr.

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Boston Edison Reduces Dividend

Edison Electric Illuminating Company of Boston declared a quarterly dividend of $3, placing the stock on a $12 annual basis, against $13.60 previously.

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Patchogue Petition Denied

Public Service Commission has denied an application of the Patchogue Electric Light Company for a rehearing on its petition to transfer its electric plant and system to the New York State Electric & Gas Corporation.

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Full Crew Law for Utilities?

Should electrically operated railroad equipment used for yard-switching purposes require a full crew of five men when privately utilized? Following citation by the Ohio Public Utilities Commission of the Ohio Public Service Company to show cause why it shall not provide the statutory full crew on its switching operations, two labor organizations filed a brief seeking to establish legal basis for a ruling by the commission that five-man operation was required by law. The brief concludes with the assertion that performance of switching service with less than the statutory crew of five men would be hazardous.

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Alabama's Rural Service

In ten years the Alabama Power Company has extended its electrical service to rural districts about eighty-five-fold. The work started in 1923, when the company took fourteen lines serving farming districts and created its rural division. Now it has 680 such lines. The company in 1931 had 2,075 miles of lines, compared with only 39 in 1923. Consumption of electricity by rural customers has increased from 175,000 kw.-hr. in 1923 to 15,250,376 in 1931.

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Receiver for Kentucky Utility

Kentucky Electric Development Company of Louisville and associated organizations of the Oscar C. Wright Company group have been placed in receivership. Percy Moore has been appointed receiver by Judge John Marshall, Jr. About a dozen small towns in Kentucky are served.

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Protests Enforced Reduction

San Joaquin Light & Power Corporation and affiliated companies on July 1 filed a reduced rate schedule, in line with the recent order of the California Railroad Commission. At the same time, A. Emory Wishon, president, filed a letter of protest as a move toward a court battle over the enforced reduction.

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Utility Under New Management

William E. Vogelback, president of the Consolidated Waterworks & Electric Company and the American Engineering & Management Corporation, has announced that these companies have withdrawn from the management of the American States Public Service Company, having sold control to the Baltimore-Gillet Company and its associates of Baltimore, Md., earlier in the year. J. B. Whitworth has been elected president of American States Public Service Company to succeed Mr. Vogelback, who remains a director.

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Protective Committee Formed

A protective committee for the class A common-stock holders of the Empire Public Service Corporation, which went into receivership last October, has been formed with Harold C. Yeager of New York as chairman. The plan under which this company was reorganizing was announced in the May 21 issue of the ELECTRICAL WORLD.

Dallas Presses Rate Cut

The City Commission of Dallas, Tex., has employed a valuation expert to check figures bearing on the demand of the city for a reduction in the domestic rates of the Dallas Power & Light Company, after the company had refused to accede to the commission's request for a reduction aggregating about $360,000 a year. On the report will depend whether the City Commission will order a complete revaluation of the company's properties.

▼

Light Beam for Pointer

Speakers can now "pack" an electric gun that shoots an arrow of light onto a screen from any point near the front of the room. The device plugs in to any convenient outlet, uses a 125-watt lamp and projects a white arrow upon any part of the slide. It also has a push button which enables the lecturer to communicate to the operator his desire for the next slide.

▼

Board Asks Name Change

The Georgia Legislature will be asked at its next meeting to change the name of the Georgia Public Service Commission to the Georgia Railroad and Utilities Commission, according to Chairman James A. Perry.

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Oregon Utilities Examined

The entire engineering staff of the Oregon regulatory department has been assigned to the work of compiling a report of the financial set-up and the valuation of the utility properties operated and controlled by the Mountain States Power Company, a Byllesby subsidiary. The commission has in progress a formal investigation involving the operator's rates, rules and practices. Following the completion of this investigation, announces the commission, similar action will be instituted relative to the properties and operation of the California-Oregon Power Company, another Byllesby holding.

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Marion (Ind.) Rate Case Revived

New evidence has been presented to a three-judge court in the Indianapolis district of the federal court by the Indiana Public Service Commission in support of its emergency order of January 16, which attempted to reduce electric rates charged by the Indiana General Service Corporation at Marion, Ind., by 20 per cent, pending a final hearing. (ELECTRICAL WORLD, April 30, page 762.) The court ruled that ten days would be given for attorneys on each side to submit suggestions for special findings of fact.

24-Kw. Neon Beacons for Providence Tower

Successful experience with a most unusual installation of hot-cathode gaseous discharge tubes for the illumination of the tower of the new Industrial Trust Building at Providence, R. I., may lead to a more complete installation at this point when business conditions improve. The tubes now used form a fixed red beacon about 427 ft. above the street, and the present installation consists of four dozen 490-watt units, each about 18 in. long x 1 in. in diameter, mounted 4 ft. behind ribbed glass windows. Space has been provided for an ultimate installation of 160 such tubes, giving a future connected load of nearly 80 kw., against the present approximate 24 kw.

Various types of tubes were tried before the directors of the trust company settled upon hot-cathode units. The final choice was based upon appearance and upon the ability of these tubes to operate satisfactorily at temperatures approaching the freezing point. The tubes have been designed to run on 115-volt circuits without transformers. Considerable difficulty was experienced, it is said, from breakage in the earlier stages of this pioneer application, but the tubes now yield a life of at least 900 to 1,000 hours each. The auxiliary starting switches for the tubes are mounted on inclined shelves near the upper floor of the tower section and each tube is wired to an individual manually operated snap switch in a cabinet below the tower window section. This installation was not designed to achieve marked fog penetration, a standard revolving beacon being located on an adjacent structure.

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Standards Bureau Produces a Reverberation Meter

Elimination of the personal factor in ascertaining reverberation decay during acoustical measurements has been announced by the Bureau of Standards in connection with the perfection of an automatic device for such purposes. Rate of subsidence of the echoes is highly important in the determination by measurement of the most effective materials and designs to improve acoustical effects in auditoriums.

A special relay, using a pentode tube as an oscillator, permits the oscillator to act as a trigger circuit which stops an electric timer as the sound decays to a predetermined level of intensity.

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Hydraulic Test on Breaker Tanks

Tests to support guarantees of mechanical rupturing capacity of circuit breaker tanks may amount to 25 per cent of the cost of the breaker if the pressure is established through electrical means, according to H. Trenchman in *Engineering*. An alternative test is employed by Messrs. Ferguson, Pailin, Ltd., of Manchester, England. The tank is filled with water and subjected to hydraulic impulse by a machine capable of creating impulse pressure up to 2,000 lb. per square inch, although electrical tests seldom show more than 300 lb. pressure within the tanks. The initial impulse is followed by a series of oscillations of decreasing amplitude to simulate short-circuit conditions.

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4⅛-In. Welded Steel Examined by X-rays

A distinct advance in X-ray radiography is said to have been realized through a development in tube design and auxiliaries which permits the successful nondestructive testing of welded steel up to 4⅛ in. in thickness.

This equipment, used by Babcock & Wilcox at their Barberton, Ohio, laboratory, has been applied thus far to the examination of more than 350 ft. of welded seams in mercury boiler drums. Babcock & Wilcox have, however, been using X-ray tests of regular production for some time.

The new tube is of the fine-focus type and is capable of continuous operation at 300,000 volts. Heretofore normal operating voltage for production examination of welded pressure vessels has been limited to 200,000 volts, which was the rated capacity of the tubes available. For 4½-in. steel using 300,000 volts and 10 milli-amp. at 30-in. focal distance approximately 50-minute exposures are needed. The equipment is the product of General Electric X-ray Corporation.

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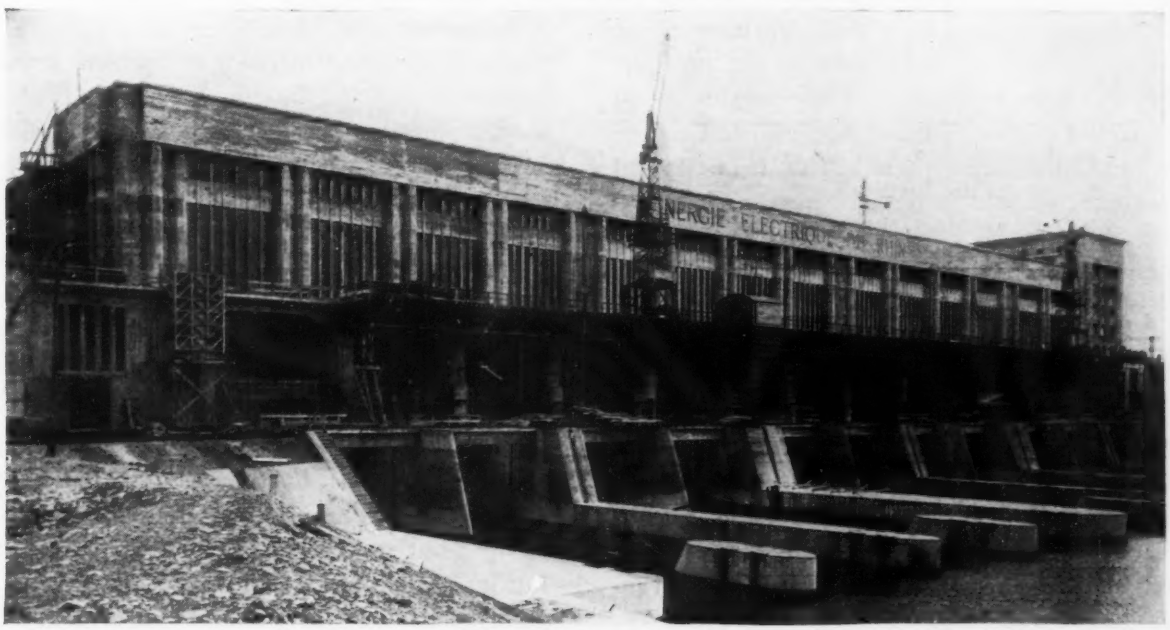
ANOTHER LARGE POWER HOUSE ON THE RHINE



Part of a comprehensive power development scheme which will ultimately involve eight sections of canal paralleling the Rhine between Strassbourg and Basle, this first station of the Kembs Works is said to be one of the largest hydro-electric generating stations in Europe. Completion is scheduled for 1934.

EDITORIALS

L.W.W.MORROW
Editor

An aid to business recovery that few understand

WIDER use of trade acceptances has great possibilities of stimulating the buying which every one admits must increase to bring about business recovery. But they will not do so unless more business men are acquainted with their nature, applicability and advantages. The American Acceptance Council, with Robert H. Bean as director, backed by Federal Reserve and other banks, is endeavoring to spread this information, but its bulletins may fall on rocky soil unless those who have digested their important message make it their personal duty to help spread the value of application of trade acceptances in stimulating better business.

Electric utilities, electrical manufacturers and large contractors constitute one group which can help themselves individually and the country at large by apprising every business client in their territory of these booklets. They might go so far as to secure copies of these Acceptance Council booklets and distribute them. But they should do more; they should point out personally some of the facts disclosed. Every group of business men in every community should be addressed on the subject.

It seems safe to say that not more than 1 per cent of the business men of this country know the applicability of the trade acceptance to their business problems, despite the fact that it came into use after the Civil War. It has been a much-bandied label, about which there is much misunderstanding. This widespread ignorance about trade acceptances is possibly one outstanding reason why buying has not recovered before now. Any attempt briefly to outline here the uses which can be made of trade acceptances and their value could not do them justice. The complete story should be obtained from the American Acceptance Council, 120 Broadway, New York.

Careful reading of the information available will reveal opportunities to break down the apparent barriers to more business which have existed up to this time.

Utilities should not be forced to insolvency levels

BEFORE a new and lively rate case is cleared from the dockets we shall probably learn whether utilities must be thrown into the maelstrom of unprofitable operation along with business in general or whether regulation is intended to give them a sustained stability through the ups and downs of the business cycle. The Wisconsin Telephone Company, instead of getting a 25 per cent increase in revenue it asked for, has been ordered by the Wisconsin Public Service Commission to make a temporary reduction of 12½ per cent pending a fuller study. Of serious import to utility welfare generally is the philosophy on which the ruling was in part based.

The newly injected concept is that utilities shall be "content with a more moderate return than is their due in times of normal or nearly normal business conditions." Public sentiment presents the biased argument that a dollar which now buys at least a third more consumable goods and certainly is in itself harder to get should also buy more kilowatt-hours or telephone service or more gas. That overlooks entirely the fact that regulation is founded on allowing a fairly fixed rate of return on investment values that average the construction and financing costs of fat and lean years. If now either rates of return or rate bases are to

be scaled down arbitrarily to meet commodity ranges, then the utility investor loses double; he lost the purchasing power of dividend and interest dollars when dollars bought less and now he loses the dollar when it would buy more.

Tearing utility securities from their moorings close to government bonds and placing them nearer the storm-tossed anchorages of speculative industrial enterprises is a move fraught with dire consequences to the solvency of savings banks and insurance companies as well as to individual investors. American Telephone & Telegraph Company will undoubtedly fight this revolutionary departure from regulatory precedent. Before long it will be known whether such a "heads I win, tails you lose" interpretation of regulatory technique can be a wholesome application of economic expediency in contrast with long-range economic justice.

Scrutinize peak equipment

DESPITE the fact that some of the ablest operating engineers in the utility industry have thus far been unable to find the point at which plants used chiefly on peak service cease to be of value, the time has come to subject the annual over-all costs of such installations to renewed severe scrutiny. The cost of new equipment and construction is now so favorable that it is unsafe to rely upon economic studies made two or three years ago in determining whether to replace old and efficient apparatus by modern products. In cases where a clear decision is indicated in favor of obtaining new apparatus it should not be unduly difficult to finance the change unless bankers and operating executives have lost all sense of proportion in the effort to avoid monetary outlays under present conditions. We do not believe that improvements which will pay for themselves in a reasonable time cannot be "sold" to financiers and managers if it can clearly be shown that the investment will save net.

It seems a long time ahead to next winter's peak, and on some systems it may be unnecessary to operate some standby equipment on these loads unless the use of energy increases beyond values included within present horizons. If such apparatus stands idle, the cost of carrying it remains to be weighed still more critically, as does the extent to which equipment of different grades of efficiency can be used in its place. Again, if loads increase beyond current trends, the strain of depending on aging apparatus deserves engineering study, and indeed the whole question of obsolescence and inadequacy should be very much to the fore this summer.

The power company's fortunate position

POWER companies that have been chiseling down their sales expenditures and curtailing their promotion programs have apparently overlooked one important feature of the present economic situation. This is the fact that while the present production of capital goods in this country is about 75 per cent less than in 1929, the production of consumer goods is only around 20 per cent less. In other words, the greatest prostration in business and the largest unemployment have taken place in those industries that produce materials and equipment for capital investment in buildings, machinery and permanent improvements. The markets for those goods that people buy for general maintenance and consumption are still 80 per cent of the high peak of 1929. And this despite the millions thrown out of work by the closing down of capital goods industries.

Fortunately the power companies sell a service of light and heat and labor saving that has come to be a necessity in more than twenty million homes. Modern living today is organized around it. So essential has it become that the domestic sales of the public utilities surpass the records of almost all other consumer services and goods throughout the depression. In fact, the growth of residence sales has almost compensated for the loss of sales to industry. And in this condition lies great security if it can be maintained.

Therefore, now is the time for more and better selling by the power companies to insure the maintenance of this demand against the intense competition of other consumer goods. It is a time to be showing every family how to economize by the more intelligent use of electricity for light, for cooking and for doing the house work. It is a time for developing more efficient sales methods and more proficient staffs.

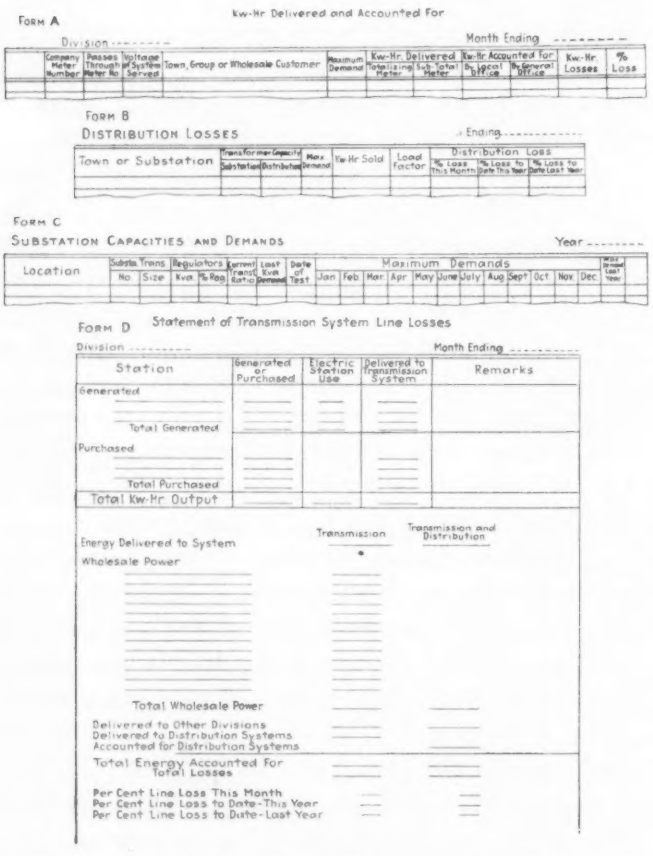
How System Losses Were Reduced

By LEO SHAPIRO

Electric Distribution Engineer
Central Illinois Public Service Company, Springfield, Ill.

Many thousands of dollars have been spent for the development of power station auxiliaries in order to reduce the cost of producing electrical energy a fraction of a mill. This energy is then poured into transmission and distribution systems whose losses are as high as 20 per cent or even more. Is it not reasonable that additional expenditures be made to reduce these high losses and to bring the transmission and distribution networks to a higher degree of efficiency?

IN THE year 1922 the Central Illinois Public Service Company had a total unaccounted-for loss of 24.9 per cent. A concentrated effort was started about that time to reduce it, and this work is being carried on at the present time. The total loss for the company for the year 1930 was 18.1 per cent, or a reduction of nearly 7 per cent from the loss in 1922. The savings in energy during these eight years as a result of the reduction in unaccounted-for losses amounted to 174,172,076 kw.-hr., or equivalent to more than $1,741,000, if energy were figured at one cent per kilowatt-hour. These figures indicate the value that can directly accrue as a result of this work. There are systems in the country whose losses are lower than ours, some as low as 10 per cent, but it is to be remembered that losses are in large measure dependent on the type of system. All of the effort in the world may not reduce the losses of a wide-flung transmission system serving many small communities to a figure as low as that which may be attained without effort at all by a compact metropolitan system. The Central Illinois Public Service Company has a service area of 18,000 square miles, including 470 communities, as well as much rural energy supply. For its type of system we feel that our company is quite successful in loss reduction.



FORM A

Kw-Hr Delivered and Accounted For

Division ---------- Month Ending ----------

Company Meter Number	Passes Through Meter No.	Voltage of System Served	Town, Group or Wholesale Customer	Maximum Demand	Kw-Hr. Delivered Totalizing Meter	Sub-Total Meter	Kw-Hr Accounted for By Local Bill Clerk	By General Office	Kw-Hr. Losses	% Loss

FORM B

DISTRIBUTION LOSSES

Month Ending ----------

Town or Substation	Transformer Capacity Substation	Transformer Capacity Distribution	Max. Demand	Kw-Hr Sold	Load Factor	Distribution Loss % Loss This Month	% Loss to This Date This Year	% Loss to Date Last Year

FORM C

SUBSTATION CAPACITIES AND DEMANDS

Year --------

Location	Substa. Trans. No.	Substa. Trans. Size	Regulators Kva	Regulators % Reg.	Current Transf. Ratio	Last Kva Demand	Date of Test	Maximum Demands Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Max. Year This Year

FORM D

Statement of Transmission System Line Losses

Division ---------- Month Ending ----------

Station	Generated or Purchased	Electric Station Use	Delivered to Transmission System	Remarks
Generated				
Total Generated				
Purchased				
Total Purchased				
Total Kw-Hr Output				

	Transmission	Transmission and Distribution
Energy Delivered to System		
Wholesale Power		
Total Wholesale Power		
Delivered to Other Divisions		
Delivered to Distribution Systems		
Accounted for Distribution Systems		
Total Energy Accounted For Total Losses		
Per Cent Line Loss This Month		
Per Cent Line Loss to Date-This Year		
Per Cent Line Loss to Date-Last Year		

Accounting for losses is the first step to reduce them

In general, the means for reducing unaccounted-for losses and improving service may be summed up as follows:

1. Reduction of transformer overcapacity.
2. Removal of severe transformer overloads.
3. Relocation of transformers to their load centers.
4. Balancing the loading on the 230/115-volt legs of the transformer.
5. Avoidance of double transformations wherever possible.
6. Balancing the phase loading on the primaries.
7. Correcting substation transformer capacities.
8. Correcting wire sizes in distribution lines.
9. Removing current "leaks" to ground.
10. Eliminating current theft.
11. Disconnecting transformers temporarily not needed or cutting out one transformer of closed delta banks during slack seasons.
12. Removing obsolete high loss transformers from the lines.
13. Securing transformers of correct voltage rating to prevent excessive core loss; also maintaining proper voltage levels on lines.
14. Improving load factors.
15. Improving power factors.

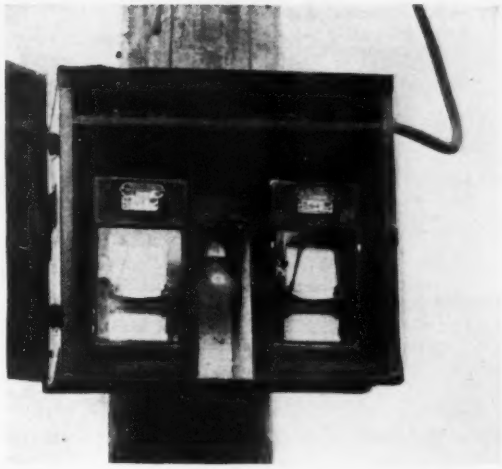
Methods for accounting of losses

In initiating the work of reducing system losses it is first necessary to determine the extent of the losses and in what sections the greatest losses occur. It is obvious that close co-operation between the operating and accounting departments is essential for successful results. All energy supplied should be metered whether it be flat rate, free or otherwise. All energy accounted for should be credited to the proper totalizing meter to obtain accuracy in the loss percentages of the various parts of the system.

The forms shown herewith are offered as a complete accounting set-up for reporting and recording system losses. Form "A" is for use by the various divisions or districts for reporting the kilowatt-hour data of their local towns and large power customers. This form is

Field metering

For ease in transportation and in mounting on a transformer pole the instruments are housed in a padded steel case. These cases are light in weight but very sturdy. The instruments may be transported within the cases as the padding is designed to protect them from moderate jars. The cases containing the graphic ammeters have a heating element to keep the instruments warm in severe winter weather. The cases containing the graphic voltmeters do not have this extra heating element as the voltmeter resistors furnish sufficient heat to keep the lubricating oil on the moving parts from congealing. In fact, ventilators are provided in the voltmeter cases to lower the temperature within them during the summer months. A special 30-ft., four-conductor cable connects the split-core current transformers with the graphic ammeters in the ammeter cases or serves as voltage leads for the graphic voltmeters in the voltmeter cases.



sent to the general office each month and the information from it, and other data of the system, is rearranged and combined to make up forms "B," "C" and "D." These latter three forms are continually and carefully studied by one individual who is charged with the responsibility of reducing the system losses to a minimum. The information obtained from this record system indicates where to concentrate on loss investigations to accomplish the most beneficial results and when to make changes in transformer and line capacities for most economical operation.

Field tests require graphic meters

The next step in loss reduction work is the actual field investigation. Some distribution engineers believe that spot tests with indicating instruments are sufficient. Such tests, however, do not always give all the information that is desired in a loss study and frequently do not produce accurate results. Too much dependence is placed on the operator's judgment of the load conditions. Graphic instruments, therefore, are recommended for all important studies.

A series of load tests was made on various classes of residential lighting loads on the company's system to determine average demand values for the different classes of service. Once these figures were established considerable time and expense was saved on all subsequent residential district studies. Such testing is repeated periodically as changes in the use of existing appliances or the introduction of new appliances in the homes alter the values of these averages somewhat in a few years.

These initial tests were made in poor and in good residential districts and in sections having varying numbers of electric ranges or other major appliances that have a decided bearing on the maximum demands. Thus demand factors and diversity factors were obtained that were later used in estimating maximum demands in distribution systems over the balance of the property without the necessity of making actual load tests. This was done by counting the number of services on the secondary system and applying the necessary factors to suit the particular class of load under consideration. This procedure is applicable only in residential districts.

Load tests always should be made in business districts and at power installations as it is very difficult to approximate the actual demand of such service by an inspection of the services or a knowledge of the connected loads. Tests in business districts should be made so as to include a Saturday night record or whatever other night the business places are open late. It is well to make such tests in the three or four weeks preceding Christmas as the greatest demands occur at that time. In residential districts load tests should preferably be made during the winter months. The results of tests made in the summer, if multiplied by 1.33, will give the approximate winter peak demands.

Load tests were made with graphic ammeters and a record of at least 48 hours, and in some cases up to a week, was obtained. The most convenient arrangement was found to be a graphic ammeter with a range of 5 amp. in connection with a split-core current transformer rated 125/5 amp. or 250/5 amp. A split-core current transformer of the combination type, having three ratios, which included a 35/5 amp. ratio, was discovered to be very desirable.

Split-core current transformers are preferred because of the ease with which tests can be made with them. They obviate the necessity of cutting the line and causing an interruption to service. The accuracy of the average split-core current transformer now on the market is sufficient for this work.

Voltage and load surveys

It is good practice to measure the voltage at the transformer and at the end of the longest and most heavily loaded secondary main during the period that the load test is being made on the transformer. It is also advisable to set voltmeters at the substation serving the town, or the feeders, during the entire time that load tests are being made in that distribution system. Thus a complete record of the voltage conditions will be obtained in addition to the information on loading. These data are of tremendous help in analyzing a system for a loss study.

Load tests on distribution transformers should preferably be made on the secondary, or 230/115-volt side, if the secondary current does not exceed the rating of the instruments used. The tests made on the high-voltage side do not give information with reference to the load balance between the two legs of the transformer. This information is just as valuable (if not more so) as the total load of the transformer. Low-voltage complaints and transformer failures are often found to be a result of a severe case of leg unbalance. Tests made on the high-voltage side of a distribution transformer are also

*Table I—Group Demand Factors**

	Per Cent
Heavy business districts	80
Light business districts	90
Factory districts — lighting	90
Factory districts — power	..
(Dependent upon the characteristics of each individual group)	
Residential districts — more than 20 customers	33
Residential districts — less than 20 customers	50

*Results of tests on system of Central Illinois Public Service Company.

*Table II—Quick Estimation of Transformer Capacity**

	Kw.	Kw. Demand
Business lighting	1.5 connected will produce	1.0
Residence lighting (less than 20 customers)	5.0 connected will produce	1.0
Residence lighting (20-50 customers)	7.5 connected will produce	1.0
Individual ranges	1.0 connected will produce	1.0
Three ranges on one transformer	3.5 connected will produce	1.0
Six ranges on one transformer	5.0 connected will produce	1.0
Nine ranges on one transformer	6.5 connected will produce	1.0
Power (groups of small motors)	2.0 connected will produce	1.0

*Derived from tests on system of Central Illinois Public Service Company.

*Table III—Ranges Plus Usual Service**

No. of Ranges	Size of Transformer to Use, Kva.
1 (3.5 kw. or smaller)	3
1 (larger than 3.5 kw.)	5
2 — 4	5
5 — 9	7½
10 — 14	10
15 — 20	15

*This table applies to transformers carrying range loads in addition to lighting and appliance loads, with range loads predominating, and covers average conditions. Lighter loading may be necessary in some cases. If heavier loading than indicated in the table is attempted a careful survey of the diversity and amount of load should be made.

Table IV—Loss Reduction on System of Central Illinois Public Service Company

Year	Per Cent Loss	Kw.-Hr. Loss	Kw.-Hr. Loss if 1922 Per Cent Loss Had Prevailed	Kw.-Hr. Additional Loss if 1922 Per Cent Loss Had Prevailed
1922	24.9	30,186,662	30,186,662	.....
1923	22.5	37,649,724	42,950,000	5,300,276
1924	20.4	40,136,328	51,900,000	11,763,672
1925	19.5	43,938,305	60,200,000	16,261,695
1926	18.6	47,676,574	69,100,000	21,423,426
1927	18.4	50,994,551	74,000,000	23,005,449
1928	17.9	57,867,896	88,000,000	30,132,104
1929	17.9	63,842,095	97,100,000	33,257,905
1930	18.1	66,472,451	99,500,000	33,027,549
		438,764,586	612,936,662	174,172,076

more hazardous to the workmen and should be avoided from the standpoint of safety.

The results of the load and voltage surveys can be studied in an effort to improve the operating efficiency of the system. Services can be balanced to produce equal loading on both legs of the transformer. Secondary mains can be rearranged or combined to reduce the number of transformers in the system or to produce a more satisfactory distribution of the transformer capacity. These surveys will also show which transformers are underloaded or severely overloaded so that changes in capacity can be made if such changes are calculated to result in savings.

It is a good plan to draw up a proposed design for every distribution system that is not properly laid out at the present time. The present layout may be the cause of unsatisfactory voltage conditions in some sections and high losses generally. If it is not possible to rebuild the systems in their entirety, these proposed designs can be used as a reference when rebuilding parts of the systems or making extensions, and the changes can be made to conform with the ultimate future layout. In this manner the systems will eventually be entirely rebuilt to a definite plan, resulting in improved service and reduced losses. Information on ways and means to reduce losses should be brought to the attention of all construction and operating forces from time to time.

Increasing the wire size in parts of the distribution system is often found to produce beneficial results. Let us assume, for example, a 25-kva. transformer feeding balanced three-wire, 230/115-volt lighting loads each way from the transformer, at a distance of 400 ft., over No. 4 secondaries. There will be approximately 55 amp. flowing in each branch of the circuit for an equivalent average period of four hours per day. The voltage at the load, under these conditions, would be about 219 volts, which represents a drop of approximately 5 per cent. The energy loss due to this voltage drop amounts to $15.65 per year, figuring cost of energy at $0.01 per kilowatt-hour.

The loss in revenue due to lesser current consumption as a result of the 5 per cent voltage drop at the customer's service is $129 per year, figuring this energy at $0.05 per kilowatt-hour. Thus the 5 per cent voltage regulation of this one particular system involves a total loss of $144.65 per year. Doubling the wire size in the secondary will reduce the line loss by $7.83 per year and increase the revenue in the amount of $63.80. Thus a total gain of $71.63 per year would result from this change in wire size. The cost of making the change involves an expenditure of only $120.

A subsequent article will deal with the adjustment of transformers to demand, selection of voltage levels and the detection and reduction of losses.

▼

Some Conclusions on All-Wood Line Construction

"Lines of all-wood construction are much less susceptible to lightning flashovers than designs used in the past. On lines of all-wood construction guyed poles are more susceptible to flashovers due to lightning. This is more prominent on vertical corner poles. Severe pole and arm damage due to splintering by lightning is no more serious on all-wood construction than on older types of construction. All-wood construction is more subject to small splintering by lightning, but this is not serious because of the slight damage. Fused grading shields are a very reliable means of protecting grounded steel frame switches from flashovers due to lightning. Switches of all-wood construction are practically free from flashovers due to lightning. Wood guy insulators will not shatter or splinter due to lightning discharges if they are protected by arcing horns with proper ratio between length of wood section and air gap. Arcing horns applied to guy strain insulators increase the susceptibility of all-wood construction to power flashovers due to lightning. Porcelain insulators appear to have suitable characteristics for guy insulators and should be given thorough trial on operating lines."

Some of these conclusions, reached by the engineers of a large system after about two years of experience with a number of lines of this type, may be provocative of argument. That is why the name of the utility is not given here. But the purpose in publishing these conclusions is to stir up thought and discussion, not argument, so that much that remains to be learned about wood insulation in overhead lines may be more quickly brought into the light.

The final conclusion reached by the engineers responsible for the comments quoted is the most important of the lot: "There is much to be learned regarding all-wood construction and organized studies of line operation are the best and most practical means toward future development."

▼

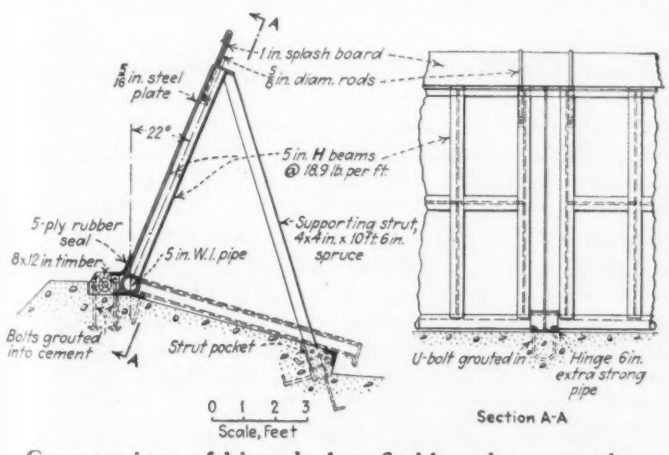
Hinged Flashboards for Headwater Control

By C. EUGENE CARTER

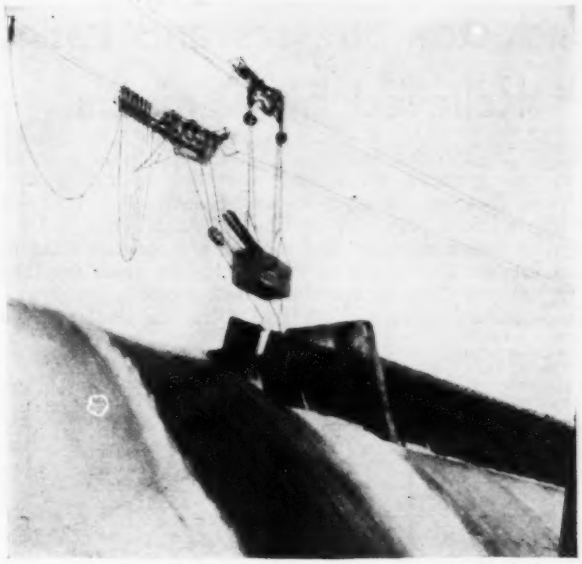
During floodwater seasons the setting and pulling of pin-type flashboards is usually a lengthy, difficult and at times hazardous job. This type of board at best can accommodate only a limited increase in head over the dam, leaks are hard to stop, and with rapidly rising water boards are often lost in spite of all precautions.

The Public Service Company of New Hampshire in raising the height of its Ayers Island Dam solved this problem in a simple and comparatively cheap manner by developing a flashboard built of steel sections, each hinged at the base, which can be lowered to form a part of the crest when not in use. The sections are built of a $\frac{5}{16}$-in. steel plate, backed by 5-in. H-beams. Each section is 7.5 ft. high and approximately 5.5 ft. wide. Along one edge is welded a 5-in. wrought-iron pipe which serves as the base. Angles along the opposite edge form a lip which engages the supporting strut on the downstream side of the dam. Before installation the pipe base is filled with concrete. The hinge is constructed of a section of 6-in. pipe welded to a plate anchored to the dam crest. The fitting of the section into the hinge to obtain a close joint between the adjacent section is shown in the diagram. When the boards are raised this joint is made watertight by means of a wedge-shaped strip of wood. The opening between the pipe base and the dam is sealed with a rubber strip.

Although the flashboards have been constructed with an adequate factor of safety and their failure is not expected, precaution was taken against possible "raveling" of the sections in extremely high water. It consisted of dividing the dam into three bays separated by concrete partitions. There are sixteen steel sections in each bay, thus giving flashboard control over approximately 263 ft. of the dam.



Cross-sections of hinged plate flashboard construction



Raising metal flashboards in high water

Raising and lowering of the boards is aided by two cableways. The downstream cableway carries a car accommodating two men, the supporting struts to be used, and control for the raising hook which is carried by the upstream cable. This hook, 11 ft. long, is swiveled at its upper end to a cable. It was cut out of 2-in. steel plate to make a square shank. Extra strength was provided by increasing the thickness of the shank at the heel. This was necessary since all the weight bears on the point alone. With the boards down and water flowing over the dam the men in the control car "fish" for the flashboard by dragging the hook upstream. The board, once caught, is pulled to an upright position and the supporting strut lowered into place, its top end engaging the lip of the board and the lower end resting in a pocket in the dam crest. This pocket is 1 ft. wide to permit easy setting of the strut and to give room for an extra strut to prevent "raveling" when only a few sections are in use in that bay. The strut hook is U-shaped and provided with spikes in the sides, which prevent slipping.

Provision was made for adding an extra foot in height to the flashboards (if needed) by making a bracket on the web of the outside H-beams in each section, which holds a steel hook to clamp down over a wooden board set on top of the standard sections.

In a recent test with a 7-ft. head over the dam crest (level with the top of the steel boards) a signalman and hoistman lowered three boards in six minutes and raised them against this head in nine minutes. At this rate the 48 sections could be raised in less than $2\frac{1}{2}$ hours. This time could undoubtedly be cut considerably with little or no head on the dam.

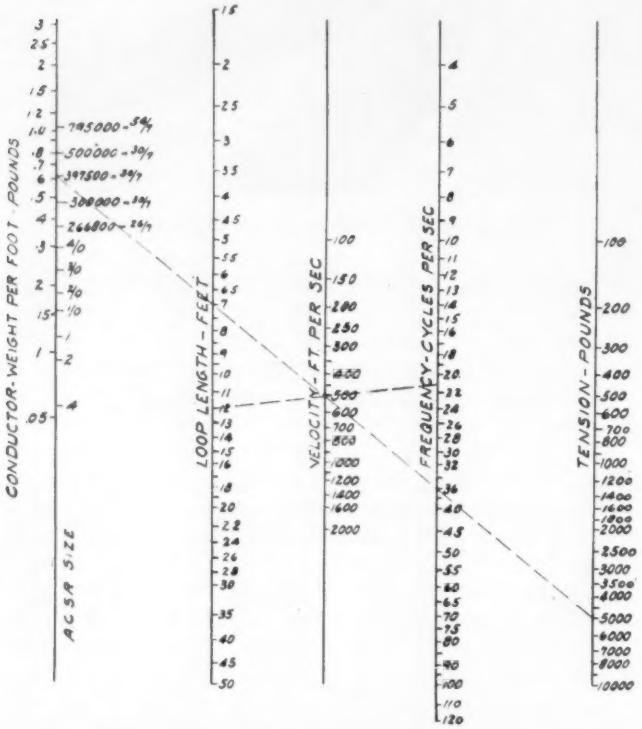
The three bays and a 28-ft. Broome gate handle 23,000 second-feet, while the total capacity of the rebuilt dam is 120,000 second-feet, compared with a 60,000 second-feet capacity handled in the flood of 1927.

W. H. Williams, engineer for the Public Service Company of New Hampshire, says of the installation: "Our experience during the past six months is that this is a very simple and positive method of headwater control."

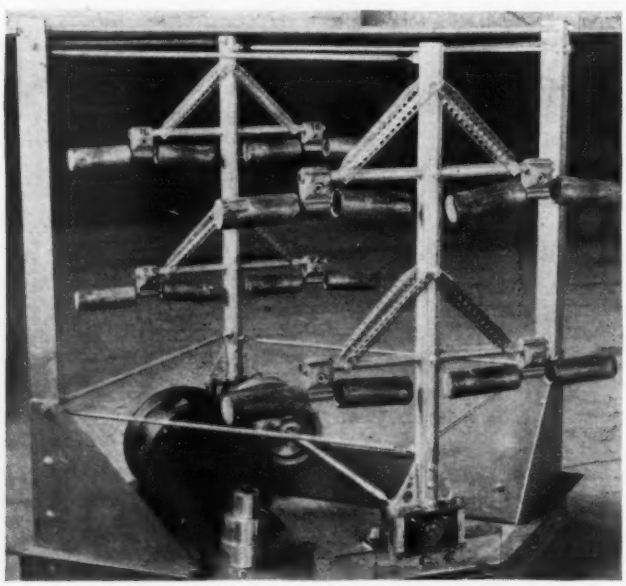
Conductor Stresses and Fatigue Relieved by Dampers

Since 1925 extensive studies of vibration have been in progress at the specially established vibration laboratory of the Aluminum Company of America at Massena, N. Y. Selected from the A.I.E.E. paper by Messrs. R. A. Monroe and R. L. Templin at the recent Cleveland meeting the accompanying illustrations indicate the source of the conclusions from the laboratory results and those of correlated field studies.

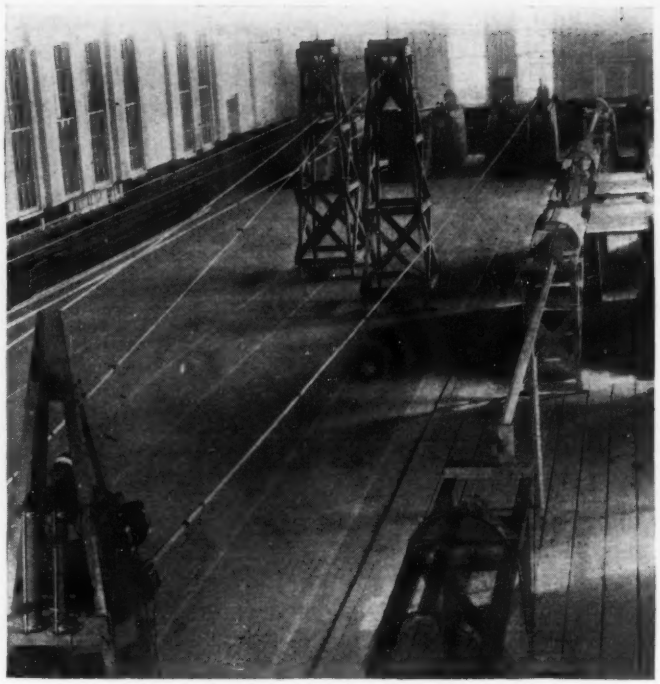
Any suspended cable will vibrate when conditions are favorable and feasible reductions in tension will not stop the vibration. Modification of cross-section and stranding do not give hope of creating a vibrationless design. Vertical stresses on the insulator are not large. The Stockbridge damper gives the best results in restricting amplitude to small values. Armor rods reduce vibration from 10 to 20 per cent but are primarily reinforcement agents. For tensions of 5,000 to 10,000 lb. on 795,000-circ.mil A.C.S.R. from 84,000,000 to 110,000,000 cycles have failed to break the first strand when cable is protected with bellmouth clamp and armor rod.



Nomogram for weight, tension, loop-length and frequency of A.C.S.R.

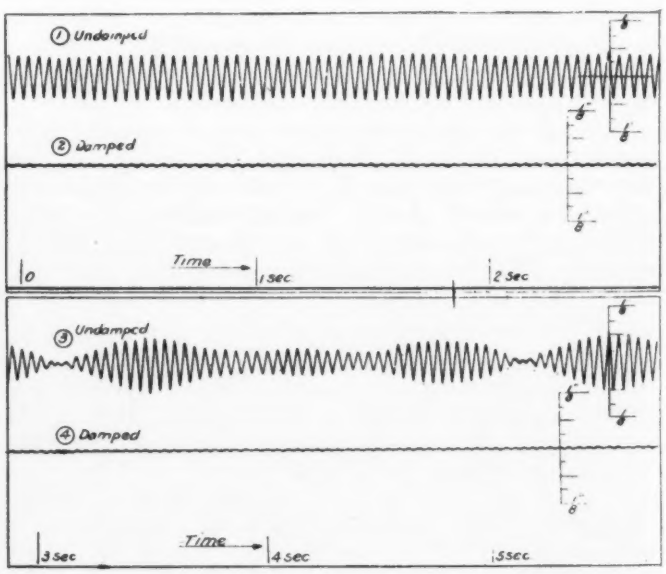


Machine determines fatigue limits of dampers



One wing of the Massena laboratory

Dampers effective on Idaho Power 132-kv. line



RECORD NO	CONDUCTOR				WIND		OBSERVED VIBRATION			CALC
	SIZE & MATERIAL	DIAM INCHES	SPAN FEET	TENSION LBS.	VELOC MPH	ANGLE DEG	LOOP LTH FT	AMPL 1/32 IN	FREQ CY PER SEC	FREQ CY PER SEC
1	4/0 ACSR	.563	550	2630	3	75	11.95	6	23	22
2	4/0 ACSR	.563	550	2630	3	75				
3	4/0 ACSR	.563	550	2650	4	75	11.7	8	23	22
4	4/0 ACSR	.563	550	2650	4	75				

Promotional Rates

Results
Objectives
Tests

By C. F. LACOMBE

Lacombe & Leffler, New York

PROMOTIONAL rates, so called, for general domestic service have been much discussed in the last few years, but little has been presented on their use and results, the objective they can attain and tests to show their effectiveness. The accompanying data have been culled from practical experience in their introduction and performance in recent years.

This type of rate came into being about 1913-14 to promote additional lighting and was utilized more and more for appliances for domestic service as they were developed and improved. Promotional rates and the efficiency and first cost of appliances and installations are closely inter-related. As fast as these characteristics of appliances improve more are sold, more kilowatt-hours are sold and rates may be decreased without loss in earning power. Two instances have recently come under observation where companies have begun paying the costs of the wiring installation for ranges and water heaters and very remarkable increases in the use of appliances and consequent heavy additions to kilowatt-hours sold and revenues have taken place in only two years. The companies were allowed to capitalize these wiring costs and the effect on revenues was so very beneficial that this policy should be carefully studied by all utilities to which this business is an important issue.

Requirements of a promotional rate

A promotional rate may be defined as a rate which from its design will develop a decreasing unit cost, if an increasing number of kilowatt-hours, or an increasing load factor, is used by the consumer. The object is that the increased use at the lower unit prices will promote increased revenue per consumer and will maintain the fair rate of return on the investment devoted to domestic service. This result can best be obtained by some form of a demand rate, either pure demand, or room or area, or other types, based on the demand theory. This is essential to provide a return on the demand or investment element of the expense of supplying full domestic service. The rate should be so designed as to encourage the small consumer to increase his usage, for each customer, large or small, is entitled to the rate he earns by his load factor.

A block rate can never develop the full promotional effect necessary for complete success. It will only be promotional to the larger customer reaching the lower priced blocks of the rate, and these customers will not be paying their share of the demand element of expense as they should. It will not encourage the small users to increase their consumption or use of their demand because they cannot decrease their kilowatt-hour costs as rapidly or as much as they can with a properly designed form of a demand or load factor rate. These smaller users amount to 80 to 85 per cent of all the residential customers, and it is from them that the greater volume of increased use of kilowatt-hours can be obtained by intensive promotional effort.

A promotional rate developed to its highest efficiency will be a rate priced low enough to enable the great majority of domestic consumers with incomes of from $2,000 to $4,000 per year to use electricity for all household purposes, except house heating, at a price equivalent to, or very little higher than, that at which the householder can obtain these services from other sources, coal, oil, gas and ice. If family incomes of $2,000 to $4,000 are reached by the rate, the customers with higher incomes will fall within the rate for all normal purposes.

Because there is no competition in lighting, which in time should become the smaller part in the bulk of domestic business, it is futile to assume that it is unnecessary to meet competition for the services of refrigeration, cooking and water heating. Long-established businesses compete strongly with electricity in these lines and will continue to do so. If the electric industry wants the business, it must meet competition, or households of small incomes will not use their service because they cannot afford to increase the fuel and light budget of their domestic expenses.

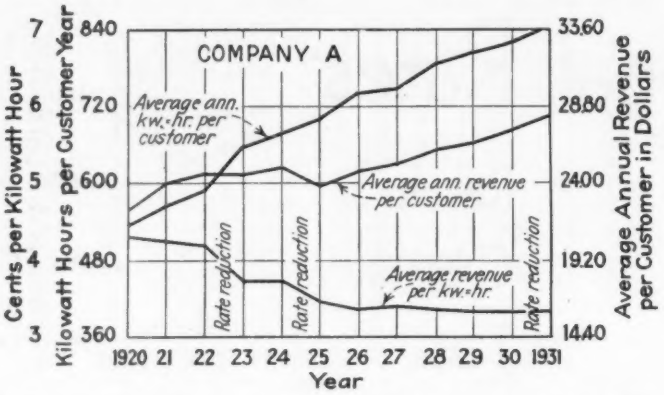
While competition must be met, the rates made must at the same time yield a fair return on the investment devoted to domestic uses. A number of promotional rates that have met competition, increased consumption and maintained revenue and a fair rate of return on the investment were introduced as long as ten to sixteen years ago. They were developed slowly to their present stage of full efficiency, reducing unit costs to both consumer and company in accordance with the growth of the use of domestic service.

These rates are now creating a larger use of kilowatt-hours per consumer each year for the companies using them, they are earning a reasonable rate* of return on the investment devoted to domestic service and have developed excellent relations with the public. These domestic customers are approaching the state of living electrically, because it does not cost them more to refrigerate, cook or heat water than it would by other means.

The contrasting effect of fully promotional and non-

**See Article "Defects of Straight Line Rate," C. F. Lacombe, W. S. Leffler, "Electrical World," page 243, February 2, 1929.*

Fig. 1—Eleven years' experience with promotional rate (Company A)



The promotional rate started about 1914. Of particular interest is the steady gain of use per customer. The revenue-per-customer line would have shown the same persistent gain as the kilowatt-hours-per-customer line except that voluntary reductions of 1 cent per kilowatt-hour were made in the first rate step in 1923 and 1925. The 1923 rate reduction produced a marked increase in kilowatt-hours per customer, but that of 1925 was not so effective, probably because the percentage of customers using energy under the first step only had decreased under the general promotional effect. The demand requirements of the rate are such that 75 per cent of the customers can reach the second step of the rate.

The rate in 1921, with discount, was 7 cents per kilowatt-hour for the first 60 hours' use of demand, 4 cents for the next 120 hours' use and 1½ cents for the excess used. The rate in 1931, with discount, was 5 cents per kilowatt-hour for the first 60 hours' use of demand and the other steps remained unchanged. The demand requirements were quite low and other factors of the rate were unchanged during the period shown.

Kilowatt-Hours Sold

Year	Total Domestic	Per Customer
1921	42,304,000	564
1931	124,267,985	842
Increase	81,963,985	278
Per cent increase	193.7	49.3

Revenue per Customer (Average):

	Annual	Monthly
1921	$24.00	$2.00
1931	28.07	2.34
Increase	$4.07	$0.34
Per cent increase	17	17

Price per Kilowatt-Hour (Average):

1921, 4.3 cents; 1931, 3.3 cents; decrease, 0.01 cent — 23.5 per cent

Number of Customers (Average):

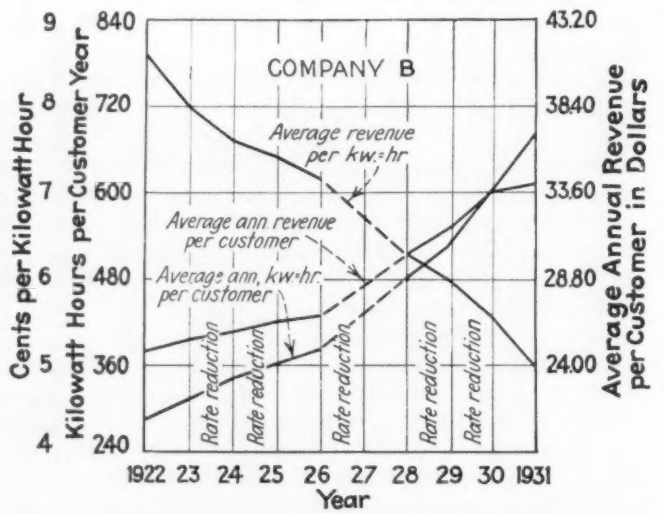
1921, 75,000; 1931, 147,550; increase 72,550 — 97 per cent

promotional rates in definite cases is presented here in three historical charts. The first two of these charts show the objective and results obtained by promotional rates in force for eleven- and nine-year periods and the third shows the results of maintaining non-promotional rates for six years and prior thereto and the effect of a preliminary promotional rate for the last three years. The charts with their accompanying data practically explain themselves. Where rate reductions are indicated in the charts it means that they occurred in the year immediately preceding. In other words, a rate reduction shown between 1922 and 1923 actually occurred in 1922.

The important observations to be made from this simple form of presentation of the growth of these three companies are these:

Company A, Fig 1, with an increase in eleven years of 193.7 per cent in kilowatt-hours sold, increased the kilowatt-hour sold per customer 49.3 per cent or 278

Fig. 2—Nine years' progress with a promotional rate (Company B)



The promotional rate started in 1922. Except for the primary change from the straight-line rate in 1921, all the rate reductions were made in the second and third steps of the rate. The rates are of the area type and cannot be stated separately without too much repetition.

At the end of 1930 a rate for complete domestic service (lighting, refrigeration, cooking and water heating) was instituted. For a household of 1,200 sq.ft. rating the rate was $1.50 demand charge, 3 cents per kilowatt-hour for the first 200 kw.-hr. and 1½ cents for excess use. If the 1½-cent rate is used for water heaters 85 per cent of the use must be off-peak. There is also a separately metered rate for 85 per cent off-peak water heating alone, of 1 cent per kilowatt-hour. These rates are so designed that 60 per cent or 34,100 of the customers can reach the second step of the rate.

Kilowatt-Hours Sold:

Year	Total Domestic	Per Customer
1922	9,036,023	287
1931	38,675,530	680
Increase	29,639,507	393
Per cent increase	328	136.9

Revenue per Customer (Average):

	Annual	Monthly
1922	$24.83	$2.07
1931	33.95	2.83
Increase	9.12	0.76
Per cent increase	36.7	36.7

Price per Kilowatt-Hour (Average):

1922, 8.53 cents; 1931, 5 cents; decrease, 3.53 cents — 41.5 per cent

Number of Customers (Average):

1922, 31,441; 1931, 56,859; increase, 80.8 per cent.

Fig. 3—Nine years' experience with domestic service (Company C)

These data are shown in contrast with Figs. 1 and 2. In the last five years the rates of this company have taken a preliminary promotional form, but with unit costs too high to develop more than partial progress toward results obtained under promotional rates by companies A and B.

The results up to about 1928 were obtained from a two-rate, two-meter system—one for lighting and one for refrigeration, cooking, etc. At that time a new rate superseded the old and

Kilowatt-Hours Sold:

Year	Total Domestic	Per Customer
1922	36,499,994	375
1931	167,543,336	571
Increase	131,043,362	196
Per cent increase	359	52.3

Revenue per Customer (Average):

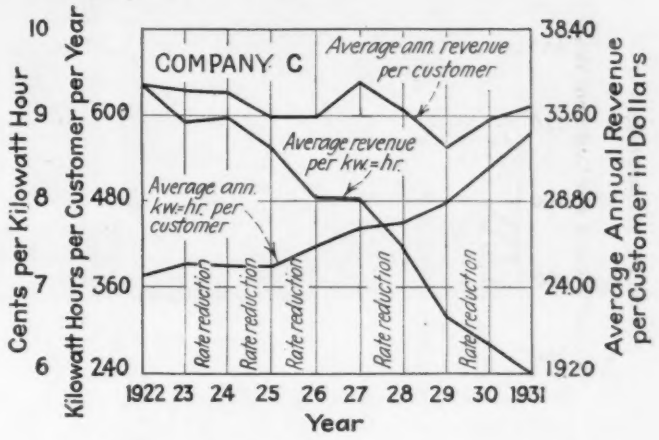
	Annual	Monthly
1922	$35.23	$2.93
1931	33.85	2.82
Decrease	$1.38	$0.11
Per cent decrease	3.9	3.9

Price per Kilowatt-Hour (Average):

1922, 9.38 cents; 1931, 5.93 cents; decrease 3.45 cents — 36.8 per cent.

Number of Customers (Average):

1922, 97,187; 1931, 293,283; increase, 201.8 per cent



most installations went on one rate and one meter. The results are not segregated, so comparison can be made of the conditions before and after the promotional rates.

The rate now being used is about 7½ cents per kilowatt-hour for the first 25 kw.-hr., 5 cents for the next 75 kw.-hr. and 3 cents per kilowatt-hour for all excess. The second and third steps are too high to obtain real promotional effects because they are above the critical prices per kilowatt-hour found necessary for ranges and water heaters in general practice. They are also too high to compete with other sources of domestic service for small incomes.

kw.-hr. and the annual revenue per customer from $24 to $28.07 in the face of a reduction of 1 cent per kilowatt-hour in average earned rate.

Company B, Fig. 2, with an increase in nine years of 328 per cent in kilowatt-hours sold, increased the kilowatt-hour sold per customer 136.9 per cent or 393 kw.-hr. and the revenue per customer from $24.83 to $33.95 in the face of a reduction in price of 3.53 cents per kilowatt-hour.

Company C, Fig. 3, with an increase in nine years of 359 per cent in kilowatt-hours sold and an increase of 52.3 per cent of kilowatt-hours sold per customer, or 195.7 kw.-hr., developed a loss in revenue per customer from $34.80 to $33.60, or $1.10, with a reduction in average price per kilowatt-hour of 3.45 cents in the nine years.

The figures show, in spite of almost the heaviest reduction in price per kilowatt-hour and the largest gain in total kilowatt-hours sold in the period, that neither factor has been successful in increasing revenue per customer over the period until lately, when an increasing trend appears in 1930, but decreasing in pace in 1931. An actual decrease occurred of 3.2 per cent in the nine-year period. Under the promotional rates of companies A and B gains of 17 per cent and 36.7 per cent in revenue per customer have been attained in the eleven- and ten-year periods.

It must also be noted that the yearly revenue per customer in 1931 in Company C, $33.60, is a little below Company B and higher than "A," but it does not necessarily follow that the rate of return for the residence class in Company C is higher than "A," for Company A's residential load factor is undoubtedly higher than that of "C," their customer costs are about equal and their production costs low.

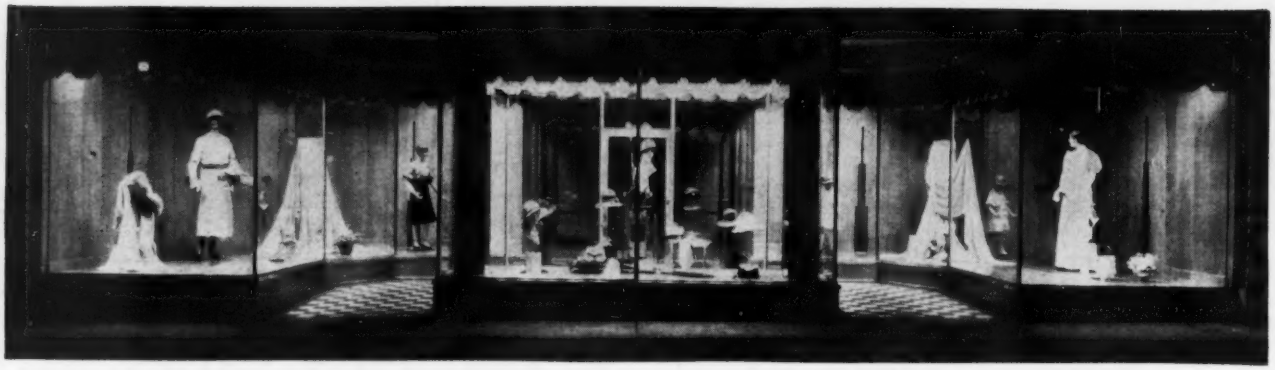
It is well to note that Companies A and B have so designed their rates that customers with small demands and monthly consumptions can reach the second or promotional step of their rate and thereby are induced to increase their use of energy at a materially reduced price. This is important, for it is from the small householder that larger users can be evolved by this policy.

Comparisons between real promotional and partial or non-promotional rates invariably show results similar to those which have just been described, when the promotional rate is properly designed, introduced and efficiently sold.

The selling of a promotional rate is a fundamental element of its success. A good promotional rate will sell itself very slowly and a persistent and consistent selling campaign should never cease. Such a campaign with a good rate will not fail to bring in increasing returns from the greater number of kilowatt-hours sold. The rate can then be lowered to bring it to the requisite standard of return desired from the residential class. The lowered rate will increase the sales and in this way a regenerative effect can be secured that will be beneficial to all concerned.

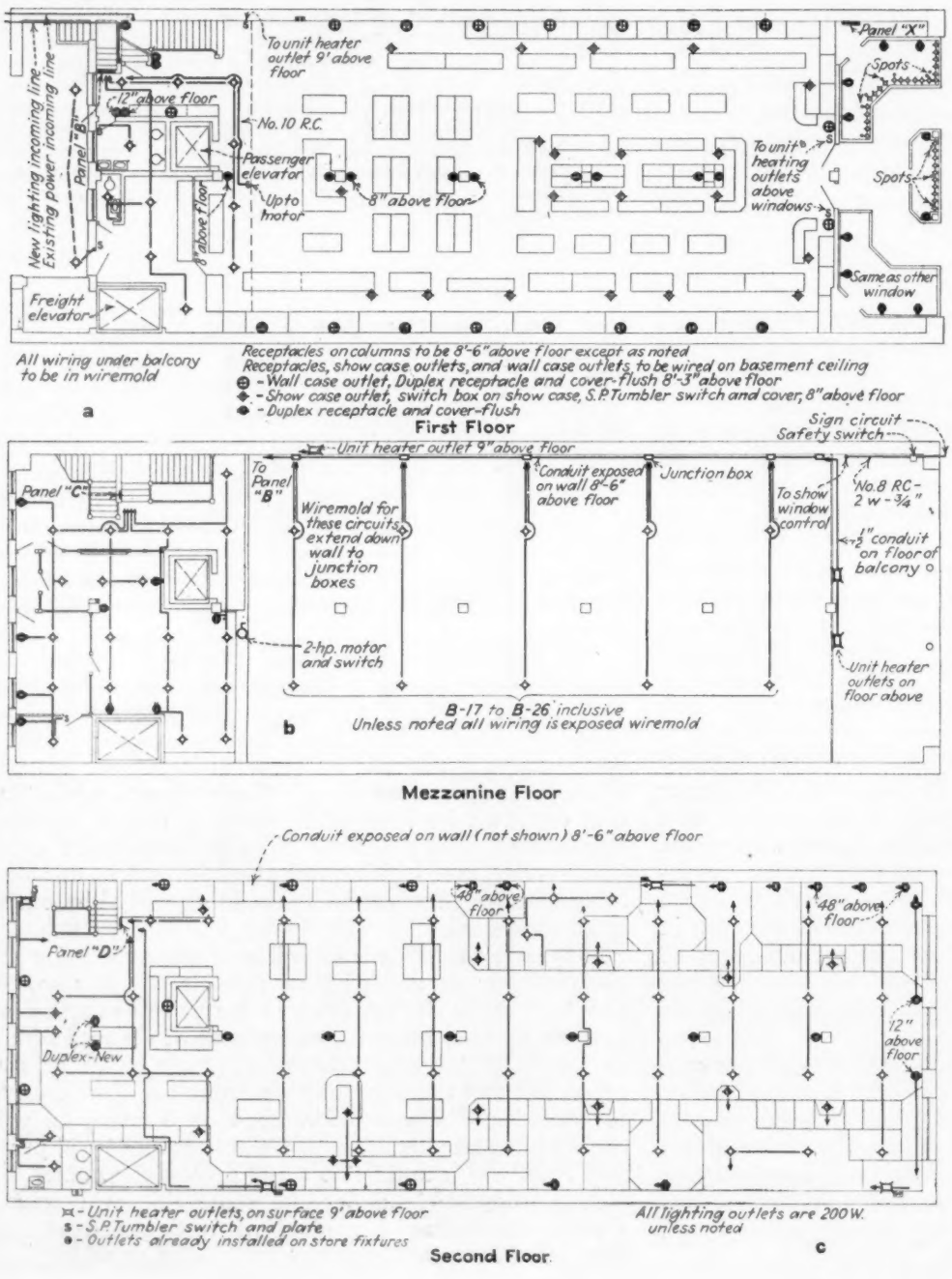
It is obvious that it is desirable to make the price per kilowatt-hour as attractive as possible. It is also desirable to make the first step of the price as narrow as possible, so as to bring the second step of the rate within the reach of the small consumer. As soon as he can reduce his cost per kilowatt-hour from, say, 7 or 6 cents for additional kilowatt-hours to 4 or 3 cents, he will begin to increase his usage and will become a good prospect from which to develop a full domestic customer.

A second article under the same title will follow shortly, illustrating a method of testing promotional rates for their earning power.



Adequate Wiring Assures Full Lighting Value

By ROY A. PALMER
Illuminating Engineer
Southern Public Utilities Company


To unit heater outlet 9' above floor
Panel "X"
Spots
12" above floor
No. 10 R.C.
Passenger elevator
Up to motor
8" above floor
To unit heating outlets above windows
Spots
New lighting incoming line
Existing power incoming line
Panel "B"
8" above floor
Same as other window
Freight elevator
All wiring under balcony to be in wiremold
Receptacles on columns to be 8'-6" above floor except as noted
Receptacles, show case outlets, and wall case outlets, to be wired on basement ceiling
- Wall case outlet, Duplex receptacle and cover-flush 8'-3" above floor
- Show case outlet, switch box on show case, S.P. Tumbler switch and cover, 8" above floor
- Duplex receptacle and cover-flush
a
First Floor
Sign circuit
Safety switch
Unit heater outlet 9" above floor
To Panel "B"
Panel "C"
Wiremold for these circuits extend down wall to junction boxes
Conduit exposed on wall 8'-6" above floor
Junction box
To show window control
No. 8 RC - 2 w - 3/4"
1" conduit on floor of balcony
2-hp. motor and switch
Unit heater outlets on floor above
B-17 to B-26 inclusive
Unless noted all wiring is exposed wiremold
b
Mezzanine Floor
Conduit exposed on wall (not shown) 8'-6" above floor
48" above floor
48" above floor
Panel "D"
Duplex-New
12" above floor
- Unit heater outlets, on surface 9' above floor
- S.P. Tumbler switch and plate
- Outlets already installed on store fixtures
All lighting outlets are 200 W. unless noted
c
Second Floor

CO-OPERATION between the architect, consulting engineer, electrical contractor, store owner and illuminating engineer resulted in an outstanding wiring and lighting job in a building which was revamped for a new department store in Greenville, S.C.

Colonel Keith, the owner of the building, was thoroughly convinced that good lighting was one of the greatest assets in successful merchandising and that an adequate wiring system was necessary in order to get the most for his lighting dollar. Accordingly, he demanded a high level of illumination of highest quality and sufficient copper capacity to insure against losses and to provide for future requirements.

For the main floor there are a total of ten semi-indirect units, one in each bay, equipped with 1,000-watt inside-frosted lamps. About 17 foot-candles is obtained by this system. All of the show cases and wall cases are illuminated. Seventeen outlets 8 ft. 3 in.

Fig. 1 a, b, c—Location of outlets and circuit groupings

Fig. 2—Lighting of second floor
For location of outlets see Fig. 1c.

above the floor along the wall supply the wall cases and twenty floor outlets supply the show cases. Eight duplex outlets on the columns are available for additional lights or for fans.

The mezzanine floor is wired for 200 watts per outlet. Glass-inclosing globes are used here and a level of illumination of 18 foot-candles is obtained, which provides comfortable seeing for the office work performed in this location. Eight convenience outlets are available for office machines or fans.

The second floor is also illuminated by a semi-indirect system using 200-watt inside-frosted lamps which provide a level of illumination of 14 foot-candles. Outlets are installed to supply wall cases and show cases and convenience outlets are available for portable lamps, fans or serving machines.

Since the building is of fireproof construction, it was necessary to run most of the circuits in exposed wiring channels. The wiring is installed in accordance with the N.E.L.A. specifications for adequate wiring. No. 14 wire was eliminated from the job. No. 12 B. & S. gage wire was used for all branch circuits excepting where the run was more than 50 ft. from the panelboard, where No. 10 B. & S. gage wire was used to the first outlet.

The incoming line is two 500,000-circ.mil per phase, installed in two lines of 3-in. conduit. Risers of adequate capacity feed distributing panels on each floor. A separate cut-in is made for power.

A feeder is brought from the main distribution panel to the front of the store to a panel supplying the show windows. A magnetic contactor connected to the power company's controlled sign circuit is used instead of a time clock. The window lights are thereby controlled for night burning. For daytime burning a double-throw switch cuts out the sign circuit control and throws in the contactor by energizing it from the store circuit.

The panelboard for the show window controls the lights in groups so that low, medium and high levels of illumination are obtainable. In addition, each of the spotlights is individually controlled. The entire arrangement of the show-window lighting is most flexible, permitting any combination demanded for the most effective lighting of any display. There are a total of 42 outlets in the two large show windows in addition to eight spotlights and eight convenience outlets, while the island window is equipped with ten outlets for general lighting in addition to two spotlights and two convenience outlets. All show-window outlets are wired for 200 watts each.

▼ ▼ ▼

Manhole Fire Apparatus

Manhole fires are infrequent, but they may have far-reaching results when they do occur. The fire-fighting apparatus illustrated here was recently developed by the underground department of the Cleveland Electric Illuminating Company. On the truck trailer are mounted fifteen large tanks of carbon dioxide. The cylinders are manifolded in such a way that one tank at a time may be discharged. The gas at a pressure of about 800 lb. per square inch is directed into the manhole with the wide nozzles shown. The carbon dioxide under pressure acts in a double capacity. It smothers the fire and at the same time, by its rapid expansion, absorbs large quantities of heat, thus cooling the equipment in the manhole very quickly.

Five Popular Illusions

By H. P. LIVERSIDGE *

Vice-President and General Manager Philadelphia Electric Company

POPULAR misconceptions or fancies are of considerable importance to all of us, because what the public knows or believes it knows of our industry fixes, in the last analysis, its attitude toward our industry. Five popular fancies stand out. They are:

The exaggerated idea that electrical energy can be transmitted great distances with economic justification.

The erroneous belief that because local electric systems exist side by side, complementing and supplementing each other, wherever their lines touch they, as a group, form a single, magnified network.

The notion that natural water power, if fully developed, would supply a very important part of the total demand for electrical energy.

The theory of mouth-of-mine generation of electricity which fails to give proper weight to all the factors involved.

The groundless fear of great extension of interstate transmission lines so vast and complicated as to form almost an entangling web—endangering, throttling, if you please, the very life and progress of our nation.

Not one of these statements has a basis in fact, either in theory or practice. I know this, and so do you; yet the public which we serve, whose future is so closely interrelated with ours, bases its decisions and ofttimes its actions on these fanciful ideas.

There are two conclusive facts which establish beyond question the now-existing local character of the electrical industry. They are: (a) The average distance of energy flow based on the latest survey is approximately 22 miles for the nation as a whole; while if the far West be excluded the average is approximately 17 miles; and (b) less than 15 per cent of the total electrical energy generated in the country as a whole ever crosses the political state boundaries. The remainder, 85 per cent of the total, is used in the state in which it is generated.

All the history and economics underlying the development of power production and its supply indicate most conclusively that the point of production must be as close as practical to the point of utilization.

This fundamental requirement is not due to any personal whim or fancy. It is determined by the rigid dictate of economic necessity. This necessity or requisite arises from the fact that large central generating plants dependent on a diversity of load for greatest over-all economy must be able to compete in price with the smaller private industrial plant. Every added mile of transmission lessens that competitive advantage. The price differential finally reaches nil, and the limit to further expansion is definitely fixed.

Future generating plants will not grow by reason of a continuous program of transmission extensions reaching farther and farther away from the source of supply in order to reach the point of consumption.

This, of course, does not apply to such special examples as water-power developments, which usually have extremely limited and specific applications.

The major supply of electrical energy to industry is a highly competitive business. It cannot be hoped to develop its use in industry unless the costs, including those of transmission, are equivalent to or lower than those that can be accomplished by isolated-plant operation. This is the very crux of the problem in so far as nation-wide extension of transmission systems is concerned.

The very nature of the problem, the economics involved and the materials and equipment available make the problem one in which transmission of power will be restricted to as limited a radius as possible, and that radius is and will continue to be the economic radius.

This radius, in my judgment, can never cover any appreciable amount of territory. In all likelihood it will gradually become more restricted as communities develop and the concentration of supply in local territories increases. In other words, the tendency in power supply is to begin with the establishment of a generating center, the stretching out to obtain increased load, and then establishing new centers in the expanding territories. These new units take the territorial load, and the only transmission between the established points of generation is that necessary to maintain greater over-all economy in the operation of the combined systems. And this certainly does not mean an ever-increasing power supply over long-distance transmission lines.

It is the physical interrelation of plants which makes it of vital importance that there shall be no artificial barriers placed in the way of the interchange of power. The interchange is, and of necessity must be, based on economic considerations alone. To interpose any consideration other than an economic one would be to act in a violent and destructive manner, no matter what the intention. When we consider that even the matter of line losses, usually only a low percentage of the energy flow, can prove the deciding factor in the choice between operation of two stations, it must be clear that fractional cost considerations are decidedly determining factors.

Any artificial obstacle placed in the way of the natural flow of power is economically unsound.

Where power is transferred or interchanged between utilities across one or more state lines or political boundaries, the transaction may take place in large quantities, in either direction, at different times of the day, the week or the year. The transfers in one direction may

**Excerpts from paper presented at N.E.L.A. convention at Atlantic City.*

balance those in the other direction so that the algebraic total may be zero or far less than the maximum flow in either direction, but each transfer is made because of the fact that such energy can be generated and delivered in the other state *at the time* more cheaply than it could be manufactured there. Later in the day or period the exact opposite may be true, and reverse energy can be supplied in the original area at a less cost than it can be made there. Again, the sole consideration is one of economics.

The sole justification for any exchange of power, aside from emergencies, is that it is cheaper to provide it in that way at that particular time. The point at which power is generated must be determined by fractional, fluctuating advantages. A very slight difference in cost between two power sources determines the choice. It is the economic and not the artificial unity of the territory which must be considered when the supply of electrical energy is being dealt with.

There has been much overstatement of the possibilities of water-power development in this country. In the first place, there isn't enough water power that can be economically made available to serve our present needs. In the eastern part of the country, where the bulk of industry is located, if every economic source of water power this side of the Mississippi were developed, it would take care of less than 25 per cent of our power requirements. In the West, where most of the water-power sites exist, there is less industry to create the load which alone justifies their development.

Economical operation of most hydro-electric plants is possible only in conjunction with a steam plant or plants. Moreover, owing to the high initial development cost, water power is becoming relatively less a factor as the art of generating electric energy by fuels advances. Labrador has a lot of water power going to waste and so has Central Africa, yet no one looks for any early development in either location.

Remembering always that no two cases are alike, let me summarize briefly what I have attempted to prove:

1. The great bulk of power is now produced and used locally; it will continue on this basis.

2. Power cannot at present be transmitted economically for great distances.

3. In general, the most that can economically take place in interconnections is a transfer of power between adjoining systems.

4. Political boundaries are economically irrelevant to the transfer of electric power between plants or systems. To invoke them may end economies now effected in the public interest through the interchange of electrical energy.

▼ ▼ ▼

Making a Converter Behave Itself

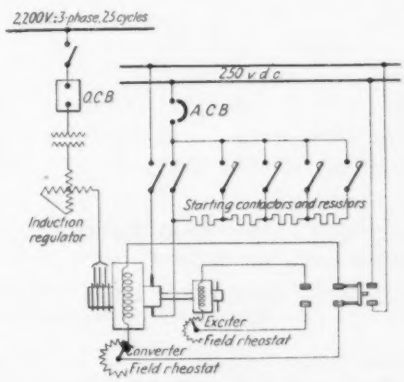
By S. EIN
Hammond, Ind.

Ill effects of low power factor sometimes appear in strange guises and are recognizable with difficulty. Such a masquerade caused operating trouble recently on a rotary converter in a large Middle Western steel mill. The station operator was unable to make the machine pick up load on one day and the next day it would behave perfectly. What caused its sulkiness? Low power factor.

The converter is supplied from a three-phase, 2,200-volt, 25-cycle system that, characteristic of steel mill systems, is not conspicuous for exact maintenance of frequency. The supply passes through a 2,200/175-volt transformation, then through an induction voltage regulator to the converter. This regulator, controlling the a.c. input voltage, is used as the d.c. load control for the converter. On its moody days the converter would not pick up d.c. load even though the regulator was at its limit of boost. The connection diagram discloses the cause of the trouble.

The machine is started as a shunt motor from the d.c. bus. In order to reduce armature current inrush and to raise starting torque all of the resistance in the converter field rheostat is cut out. After the starting resistance in the armature circuit is cut out by the contactors and the knife switch closed around them the field circuit is thrown onto the direct-connected exciter and the exciter output adjusted to synchronize the converter. If, during the starting period, the supply frequency is normal the setting of the exciter field rheostat at synchronization will be about right for the converter to carry up to three-quarters full load at a slightly leading power factor and with the induction regulator at about half boost. This was what the operator was used to. But he was not used to the condition that obtained when the supply frequency was low during the starting period.

In order to bring the speed of the converter down to synchronism when the supply frequency was low the exciter output had to be increased much above normal. Leaving the exciter field rheostat at that setting after synchronizing left a very strong field on the converter, which, of course, caused a low leading power factor. The reactive current, circulating through the impedance of the a.c. current, caused an a.c. voltage drop quite outside of the range of correction of the regulator. After analysis had shown its cause the condition was easily corrected by simultaneous lowerings of the setting of the exciter field rheostat and the position of the regulator until zero d.c. output from the converter coincided with the center point of the regulator range.



Low frequency makes rotary converter sulky

Factors Affecting Load-Dispatching Organization

By E. E. GEORGE* and C. H. ROGERS†
Tennessee Electric Power Company, Chattanooga

A STAGE occurs in the development of every power company when expansion of organization suddenly becomes acutely necessary. When the need for organization changes arises there is usually little time for study, and if there has been no thought previously given to organization possibilities the changes made may not be adequate or reasonably permanent. This is especially true of load dispatching. Expansion of load-dispatching activities creates many difficult problems which owe their intricacy to the conflict of fundamental requirements.

Therefore an analysis of load-dispatching requirements may be helpful at this time when most organizations are not expanding and when there is consequently time to plan for future improvements and prepare for sudden developments.

The fundamental purpose of load dispatching has been stated as follows: "The delivery of continuous power from changing sources of supply to customers scattered over large areas requires a centralized operating head at all times to direct the operation of the system." The operating duties of the dispatcher are too well known to merit more than casual mention—supervision of switching, allocation of power supply, control of voltage and regulation of speed.

Most problems of the load-dispatching organization arise in connection with construction and maintenance, rather than straight operation, and therefore require contact of construction and maintenance men with the system load dispatcher, who is the usual representative of the system operating department. For example, construction or maintenance work may involve the following:

Functions that require supervision during maintenance or construction

(a) Interruption to service (or stand-by) of any circuit supplied from an interconnected generating station or primary substation.

(b) Permanent additions, reductions or changes in service equipment in interconnected generating stations, primary substations or on the transmission system.

(c) Removal from service (or stand-by) or restoration to service (or stand-by) of any service equipment in interconnected generating stations, primary substations or on the transmission system.

(d) Collection of information on equipment trouble as to cause, nature, remedy, etc., so that departments responsible for design and supervision can take advantage of actual field operating experience.

(e) Collection of information on service to customers, including prearranged interruptions, emergency interruptions, voltage, etc., with data on cause, extent and duration.

(f) Record of performance of equipment which operates only during emergency, such as relays, alarm schemes, automatic equipment, etc. (In determining whether relay performance is correct or not it is usually necessary to have full information on the nature of the trouble, location, etc., even if the trouble occurred on distribution or in customer's equipment, or beyond the operating jurisdiction of the dispatcher.)

(g) Location of trouble before repair work is begun. (A co-ordinated procedure for opening switches and making tests greatly reduces the extent of interruptions and saves time and work for the departments which have to repair the trouble).

(h) Testing of equipment to locate trouble, such as is usually done by the field test men. (Some of this testing affects protection and much of it is done to check the performance of protective equipment, so that the relay engineer desires contact through the dispatcher or directly with certain test activities).

In most companies the load dispatcher is a clearing house for considerable interchange of information between the field and the office. This saves employees time and puts a better load factor on the communication system. The daily reports of the load dispatcher provide general distribution to the interested departments of up-to-date information on the activities of the company.

Facilities required by load dispatcher

It is generally recognized as a sound principle of organization that if a certain activity can be handled either centralized or locally with reasonably comparable results, preference should be given to local or district administration, at least in a growing concern. Therefore it may be assumed that load dispatching should be handled locally as far as practicable. When it is not clearly evident what is "practicable," it does not pay to experiment with or use cut-and-try methods because load dispatching is too vital a function.

Although decentralization is desirable from many standpoints, there are certain requirements of dispatching which cannot be satisfactorily delegated to local representatives. These technical requirements may outweigh reasons of policy in any organization and should always be considered carefully when the dispatching organization is being studied. Some of these requirements will be outlined and discussed briefly:

(a) The load dispatcher must be available 24 hours a day. District offices and most substations do not have some one on active duty 24 hours a day.

(b) The load dispatcher must have the best of communication facilities, with alternate routes to the more important points. Few substations, power stations or

*Superintendent system operation. †Chief load dispatcher.

company offices have adequate communication facilities for dispatching purposes.

(c) It is desirable that the load dispatcher be able to secure assistance during severe trouble. The system load dispatcher's office usually has two men on duty at all times and other men are available during a severe or prolonged storm. Few of the substations have more than one man available.

(d) The load dispatcher should not have other interfering duties. The station operator is likely to have maintenance or operating work of his own at the same time that he could be of service for local dispatching. Line foremen, maintenance foremen, local managers and other employees are very likely to be occupied with other important work at the same time that dispatching is most urgent.

(e) The load dispatcher should be at a fixed location. The line foremen, maintenance foremen and practically all construction or maintenance men are likely to be anywhere, especially during trouble, and considerable time and expense is required to communicate with them, whereas the system load dispatcher's office is the easiest place with which to communicate on the system.

(f) The importance of a central location for emergency dispatching is generally overlooked. The local man may think that his switching to locate trouble and restore service does not concern any one except him and the customers. This is true to a limited extent on distribution systems, if there is only one case of trouble at a given time and it affects only a small area, but as soon as the second case of trouble occurs the man out on the first case has taken with him the key to the situation. Nobody immediately available knows which switches are open, which customers are out, where the maintenance crew is, when they will probably be back or whether a clearance for the second crew can be safely issued.

However, if the load dispatcher or an available substation operator has been advised as to the general program, the handling of further trouble is greatly facilitated. Frequently it is necessary to call the crew off the first case of trouble and send it out on something more important, or to split up the crew into two groups. All of this work is facilitated by centralized supervision and far outweighs the disadvantage to the maintenance foreman of not being able to direct his activities independently of other crews and other departments.

(g) Experience in dispatching and operating engineering is the factor which justifies in many cases a considerable delay in activities to get in touch with the system load dispatcher. Troubles that are abnormal and unusual at any one location are likely to be routine as far as the dispatcher is concerned, because he covers so much territory and concentrates on handling abnormal operating conditions. In addition the system load dispatcher has unusually close contact with his own and other departments which can give technical advice or information.

(h) Changes in load affect speed over the entire system and voltage over a certain area. The effect of one small station is negligible, but a number of stations doing maintenance work at the same time without knowledge of the dispatcher would have a bad effect on many of the service and cost factors for which the dispatcher is held responsible. The dispatcher has to anticipate load requirements at all times in order to handle speed, voltage, interchange and cost of power to the best advantage, and only emergency and unforeseen conditions should be allowed to upset his plans.

(i) Records, maps and even dispatching boards are essential to safe and fast switching. Such facilities cannot be located at many points or used by miscellaneous personnel and still be kept up to date.

(j) A direct line of supervision and free selection of personnel is desirable in emergency activities. The dispatching department cannot exercise such control over employees of other departments.

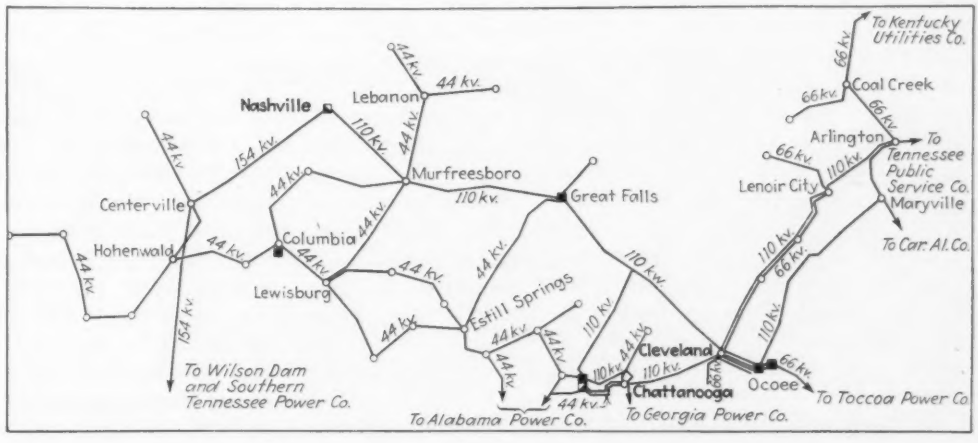
(k) The handling of trouble involves equipment difficulties and electrical phenomena which are becoming more complex, especially with the interconnection of systems and the use of electricity in so many different ways. This means that the operating organization must have the sufficient technical advice to function promptly and correctly. In this line of work there is no time to use cut-and-try methods.

(l) Experience in every utility has shown that some one department without other conflicting obligations should be primarily responsible for service and should have equal authority with construction and maintenance departments in making arrangements affecting customers. The maintenance and restoration of service very frequently conflicts with the construction and maintenance of equipment. The commercial departments have essentially the same viewpoint on service as the operating department, but the maintenance and restora-

Major lines of Tennessee Power Company

The main dispatching office is at Cleveland because the system developed first in eastern Tennessee, with Cleveland as the center of the network and telephone system, but the center of dispatching activities has moved westward with the development of the system.

Chattanooga and Nashville, the only large cities on the system, have distribution dispatching offices. The dispatchers report to the system operating department and local distribution organizations jointly and handle considerable low-tension station switching and air-break switching on the distribution lines.



tion of service is inherently a technical rather than a commercial function.

In view of the aforesaid reasons for dispatching contact with construction and maintenance activities, and the disadvantages of scattered and unsupervised representation, this contact should extend to the point where construction and maintenance activities cease to affect the system noticeably. The system load dispatcher cannot perform his major functions properly if he has to supervise the replacement of lighting customers' fuses or the connection or disconnection of residential secondaries. Local maintenance men cannot proceed far in restoring high-tension service without affecting system operation, and also affecting some other community where the local maintenance men may have a different idea of how to proceed in system operation. Somewhere between these two extremes is the logical and efficient division of central and local responsibility.

The most general practice of power companies is to take advantage of the isolating influence inherent in the high reactance of step-down transformers between the transmission and distribution systems and place high-tension equipment under the jurisdiction of the system load dispatcher and low-tension distribution equipment under the jurisdiction of the local distribution organization. Unless the step-down transformer is very large, distribution troubles do not affect the high-tension system materially from an electrical standpoint.

Importance of communication facilities

Telephone communication is the most vital element of dispatching facilities. It is the sole means which makes practicable emergency supervision of distant activities. A poor dispatcher and a good telephone system can restore service faster and cheaper than the best dispatcher with an intermittent and unreliable telephone system. In most power companies the load dispatcher is either assigned a supplementary telephone system for exclusive use with right-of-way over the general communication system or else important lines are looped through his office and he is given right-of-way over other traffic in case of emergency.

Sub-dispatchers or station operators should handle operation within the area of their local distribution system. A nearby representative is of no greater assistance than the system load dispatcher, because under present-day conditions the Bell system can usually complete a 500-mile long-distance call as quickly as one of 15 miles and the long call receives better facilities and supervision. For these reasons a community which can establish connection with a nearby toll center can usually communicate with the system load dispatcher as quickly and reliably as with a local sub-dispatcher, control operator or station operator. In communicating from a station to the system load dispatcher the weakest link is the section from the station phone to the nearest toll center. From that point on all circuits can be quickly rerouted in case of failure. Failure on the system load dispatching end is limited by special long-distance facilities and by interconnection of the company and Bell systems. The system load dispatcher is practically assured of communication to any toll center under any condition; any interruption to communication will usually be between the toll center and the outlying station.

In the largest cities distribution circuits frequently tie transmission systems together, and step-down transformers are so large that distribution troubles are reflected back on the transmission system. Also, there is usually sufficient dispatching in the large cities to take the entire time of one man so that most companies establish a sub-dispatcher in each large city. The sub-dispatcher is usually an employee of the dispatching department without other duties except dispatching. He reports to the system load dispatcher, but has authority to handle load dispatching on his own initiative and in case of interrupted communication to restore high-tension service to his area. In large cities the jurisdiction of maintenance men and station operators may be considerably less than in smaller communities where there is no sub-dispatcher.

A station operator can be of great assistance to the system load dispatcher and can relieve the communication system and the system load dispatcher's office of much detail. Records can be accumulated by the station operator as they occur and held over until a convenient time of day for reporting to the dispatcher. In switching that affects only one station the dispatcher can approve the arrangements before hand and get complete records later, but if communication is not available or the dispatcher is busy, the station operator should carry out the switching in detail without supervision.

Emergency dispatching needs special study

Most of the preceding discussion has assumed more or less normal operation of communication facilities and availability of regular employees. Before any organization set-up based on normal conditions is adopted it should be studied in the light of abnormal conditions, especially in connection with the failure of communication. While communication facilities have been improved enormously in the last few years, communication sometimes fails when it is most needed. It is exceedingly difficult to set up procedure for interrupted communication that will seem even half way reasonable to the various departments affected. The importance of communication to dispatching is well illustrated by the expedients required when it is not available:

(a) A large book of prearranged rules is required to cover only the most usual cases of trouble when communication is interrupted.

(b) Sectionalizing and location of trouble is greatly delayed.

(c) Safety precautions are reduced.

(d) Unfortunately, the lines of jurisdiction established under the assumption of adequate communication seldom meet the requirements of interrupted communication. In the absence of communication the man on the job has to be given more authority, or the job has to wait until supervision is available.

The answer is always a compromise between restoring service and utilizing organization. It is difficult to keep essential records, maintain standards, assure safety or develop a sense of personal responsibility if systematic organization is paralyzed every few day to permit the nearest crew to work on anything required to restore service in the minimum time. Nevertheless, restoration of service is essential, and in case of interrupted communication local crews are usually authorized to do anything that is necessary in order to maintain or restore service.

Customer's Primary Vaults Need More Engineering

By CLOVIS M. CONVERSE

G & W Electrical Specialty Company, Chicago

Neglect of obvious things is a general criticism of many service-entrance vaults located on customers' premises.

Here are the basic requirements of good transformer room design.

QUITE frequently the need of space for transformer installations and associated equipment used in supplying electric service to large factories and tenant buildings is an afterthought in the design of new buildings. It must be an afterthought in the case of a structure already existing. The result is that, either through necessity or failure of adequate consideration, customers' service vaults are often beautiful examples of how the job should not be done rather than of how it should be. Usually vault deficiencies lie in poor ventilation, resulting in lowered transformer efficiency, or in poor location with respect to the load.

The tendency has often been to locate a vault in some out-of-the-way place, for which no other use is apparent, when a study of the situation might show that it would be advantageous to locate it at a central point even though the space were valuable for other purposes. In the layout for a large one-story factory building recently studied it was found that by placing the vault near the center of the building at a point of maximum load density the cost of wiring was substantially reduced and much better voltage regulation secured. Both results were due to the shortening and reduction in size of the large low-voltage feeders to motors and other equipment.

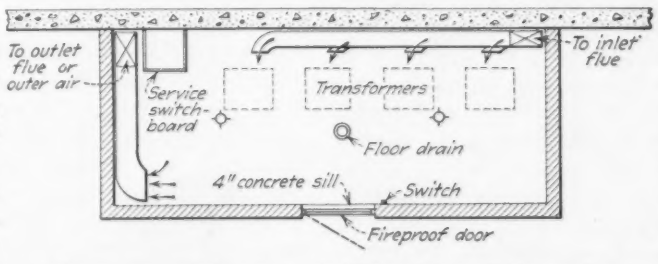
Adequate space—an essential

A number of the recently erected many-storied office buildings have taken advantage of the economies to be secured by installing the transformer equipment in vaults at carefully selected locations on the upper floors. In some of these buildings the secondaries have been interconnected to form what has been termed a "vertical network." In a large industrial plant involving several buildings a separate building to house the transformers is often desirable.

Assuming that the transformer capacities and the number have been determined, the first point to be considered in vault design is the floor area required. No fixed rule can be set up, but an allowance of 1 sq.ft. for each 2 kva. of transformer capacity is not unreasonable. Small installations may require twice this allowance. A careful layout of the vault should be made, showing the transformers, bus structure, switching equipment and other auxiliary devices. A clear space of at least 2 ft. should be left around each transformer or other device and an aisle provided wide enough to permit the convenient removal of any piece of apparatus. Crowding of equipment is dangerous at any time, and particularly in an emergency; furthermore, ample vault space provides for expansion, which is often unexpectedly necessary.

A clear height of 9 ft. is desirable; many utilities set this figure as a minimum. A height of 8 ft. is the least that should be allowed, and this must be the clear distance below any beams or other irregularities in the ceiling. The cubic feet of air space desirable in vault construction has been estimated by various authorities from 1 cu.ft. to 12 cu.ft. per kva. A fair figure would seem to be 3 to 4 cu.ft. per kva. The rule given earlier of 1 sq.ft. of area for each 2 kva. would provide 4 cu.ft. per kva. at the minimum height of 8 ft.

Fireproof construction is imperative as transformer oil is highly inflammable. The National Electrical Code calls for fireproof construction, as do all other authorities having control of vault installations. Walls must be 6 in. thick if of concrete and 8 in. thick if of brick, according to the Code; 8-in. thickness for concrete and 12 in. for brick walls is preferable, especially if the ceiling heights exceed 9 ft. Where possible it is desirable to use one or more of the outside walls of the building as a part of the vault. The floor should be reinforced concrete, designed for a load of approximately 500 lb. per square foot and should pitch at least $\frac{1}{4}$ in. per foot to the drain. The ceiling should be reinforced concrete or fireproof tile construction.



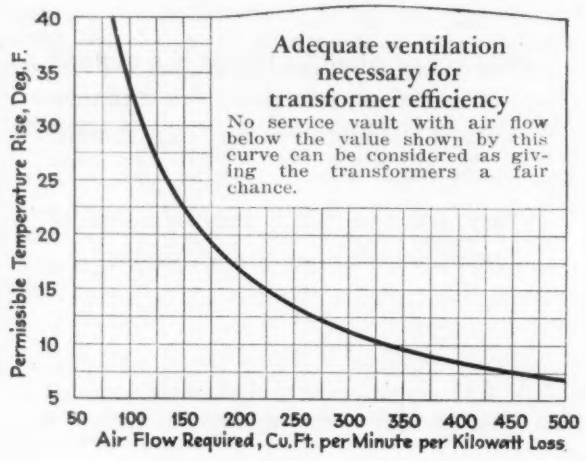
Some essentials of good design for service vaults

Ventilation, drainage, lighting, space for handling equipment and other features making for safety and efficiency are incorporated in this plan.

Access to the vault from the outside of the building, from a street or alley, is desirable and is required by some operating companies. However, such an arrangement is not always possible, especially if the vault is located in a basement. Where outside entrances cannot be

provided it is essential that there be a clear hallway to an areaway from which equipment can be easily lifted or to an elevator having a lifting capacity sufficient to handle the largest transformer.

The entrance door should swing outward and be of fireproof construction. The door opening must be wide enough to permit the removal of the largest transformer; 4x7 ft. is a reasonable minimum size and a


Adequate ventilation necessary for transformer efficiency
No service vault with air flow below the value shown by this curve can be considered as giving the transformers a fair chance.
Permissible Temperature Rise, Deg. F.
40
35
30
25
20
15
10
5
50 100 150 200 250 300 350 400 450 500
Air Flow Required, Cu.Ft. per Minute per Kilowatt Loss

width of 4 ft. 6 in. is preferable. There is some variation in requirements for fireproof doors in different localities, so that it is well to secure approval of specifications from the local inspection department before making the installation. Most utilities have a standard padlock which they furnish, so that a hasp should be provided for this purpose. A double hasp arrangement is used in many cities, the utility supplying one padlock and the owner another. In this way both may have access to the vault without the utility using a special lock or supplying the owner with one of its standard keys, which is undesirable.

Ventilation requirements

The Code requires a concrete door sill not less than 4 in. in height and higher if necessary to hold all of the oil that might be released at one time. The need for such a requirement is obvious.

To secure safe and continuous operation of transformers normal operating temperatures must be maintained. Actual temperatures obtained will depend on size and efficiency of transformers, vault arrangement, type of construction and ventilation. The dissipation of heat due to transformer losses depends to some extent on the radiation of heat through the vault walls, but to a much greater extent on air change. Since the first factors are more or less fixed it will be evident that adequate ventilation is a vital necessity in vault design. Natural ventilation is generally used, but in some cases the natural ventilation possible added to the wall radiation is insufficient to limit the temperature rise; in such cases mechanical ventilation will be required. Occasionally a vault is so located that little or no natural ventilation can be obtained; in such a case complete and continuous artificial ventilation is imperative. Free circulation of air around the transformers is essential to the maintenance of proper operating temperatures.

For natural ventilation inlet and outlet vents usually have the same area; actual sizes will be dependent on the amount of air necessary for a particular job. No fixed rule can be offered, but a number of utility specifications require a minimum of 3 sq.in. per kva., which seems to be a reasonable requirement. Vent openings should be located as far apart as possible, the inlet opening to be located not more than 1 ft. above the floor, and behind the transformers if possible. The outlet opening should be close to the ceiling and on the opposite side of the room. In small vaults one inlet and one outlet opening are sufficient, but in larger vaults it is desirable to carry the inlet duct along the wall back of the transformers with an opening behind each one. Vertical distance between openings should be as great as possible and the outlet vent, especially in the case of basement vaults, carried as far up the building wall as construction conditions will permit.

Air flow computation

The amount of air necessary for ventilation can be readily calculated, since we know from the transformer losses how much heat must be dissipated. It is fair to assume that the vault temperature must not exceed 40 deg. C. (104 deg. F.). Knowing the temperature of incoming air, we can determine the volume necessary to keep the vault at that temperature or below, assuming all of the air is used effectively. An accompanying curve shows the cubic feet of air per minute required per kilowatt of transformer loss on the basis of this assumption. In practice when natural ventilation is used this figure must be increased by some percentage dependent on vault and operating conditions in various localities, as it is obvious that complete mixing of incoming and vault air cannot be expected. Under average conditions a 50 per cent increase should be satisfactory. If mechanical ventilation is used a supply of air 10 per cent in excess of the indicated requirements will be sufficient.

Calculations to determine air flow due to natural ventilation are not so simple as little or no data are available. Theoretically, if we know the vault temperature, the outside temperature and the difference in elevation of the inlet and outlet vent we can calculate the air flow due to stack effect. Practically, this will be assisted by the stack effect of the outlet vent duct. Actually, wind direction, duct arrangement and other factors distort the results. However, the figures obtained will be some guide to duct sizes. Here too it is advisable to increase substantially theoretical duct sizes, as an excess of air is certainly no disadvantage. In some vaults it may be desirable to depend on natural ventilation to take care of usual loads and provide some mechanical ventilation to take care of peak-load conditions. Many installations of this type are provided with a thermostat to start the fan when the transformers or the vault approach maximum safe operating temperatures.

If the inlet or outlet vent openings are on the outside wall louvers must be installed to prevent the entrance of rain or snow. Often a close-mesh wire screen is necessary to keep out birds or small animals. The Code requires that all inlet or outlet vents not connected to a chimney or flue be provided with dampers, made up from sheet steel not less than No. 10 gage, to prevent the emission of flames or smoke. It is recommended that dampers be automatic in operation or arranged for control from outside of the vault.

A floor drain 10 in. in diameter should be installed near the center of the vault and connected to the sewer system. As previously stated, the floor should pitch not less than $\frac{1}{4}$ in. per foot to this drain. If the vault floor is close to the sewer level a backwater valve is desirable. If adequate drainage cannot be provided the doorsill must be of proper height, as mentioned previously.

Adequate vault lighting is a necessity; one ceiling outlet of not less than 100-watt capacity for each 150 sq.ft. of floor area is a minimum requirement, no vault to have less than two outlets, except possibly a very small one. A control switch should be provided just inside the entrance door. One or more plug receptacle outlets are necessary to provide for inspection lights and small-tool operation. All wiring must be in iron conduit and preferably connected directly, through its own fused switch, to the secondary bus. Porcelain-enameled, dome-type steel reflectors are especially suited to vault installations and are required by the vault specifications of some utility companies.

Safe, efficient and continuous operation of an industrial substation is vital to an owner as well as to the utility. While proper equipment is a prime requirement, a transformer vault of suitable size and fireproof construction, correctly arranged and in an economical location, will go far to assist in securing this result. If to this is added adequate ventilation, illumination and drainage complete success can be reasonably assured. Careful attention to vault details before installation will pay big dividends in peace of mind as time goes on.

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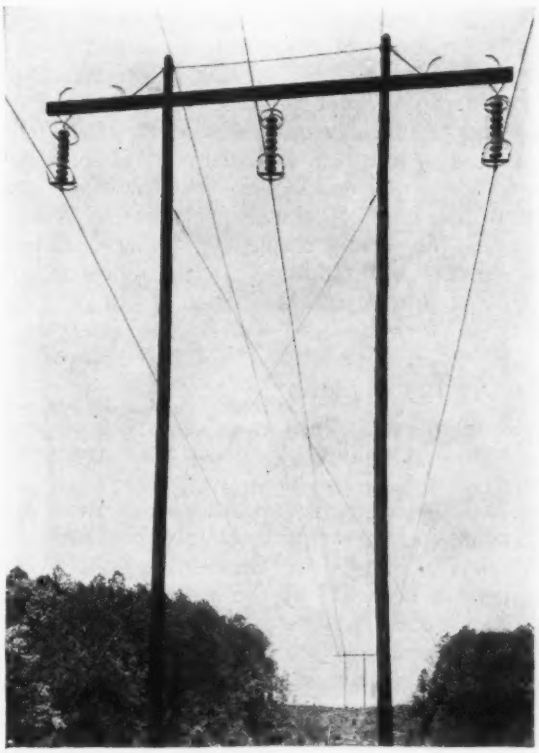
Southern 110-Kv. Structure



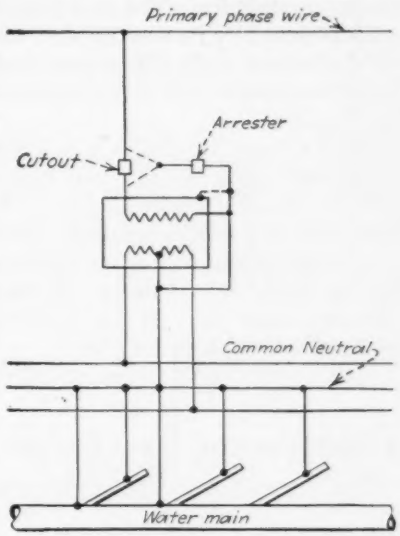
Gaps between crossarm hardware, bonded double ground wires, arcing rings and guying are features of this installation.

READERS' FORUM

Common Neutral Simplifies Transformer Protection

To the Editor of the ELECTRICAL WORLD:

The article on "Common Neutral Practice Confirmed in California," which appeared on page 980 of the June 4 issue of your journal, is a conspicuous indication of the trend toward simplification in distribution practice. It is no doubt an important and timely publication. The application of the principles employed appears to permit a further simplification not mentioned in the article, which involves the protection of the transformers against lightning. With the common neutral system described the transformer can be given virtually complete protection against lightning by the use of only one lightning arrester connected from the primary phase wire to the neutral, at the transformer, as indicated in the above illustration.



The potential differences around the transformer are limited by the arrester to the arrester voltage alone. The deleterious effects of the length of the arrester ground lead and the arrester ground resistance present in the old and widely used methods of separately grounding the arresters are not present here. High voltages will not appear between the secondary and ground because of the thorough neutral grounding.

If an arrester of the valve type is used it may be connected on either side of the primary cut-out, without running the risk of an arrester operation causing the usual fuse links to open. The transformer tank is preferably tied in with the grounded neutral wire. Omission of this connection, however, will not seriously impair the protection to the transformer.

The connection of the primary arrester to the secondary neutral is considered by many to violate the letter of the safety codes. However, when and where the use of a common neutral has been given the stamp of approval there can hardly be any objection to the connection of the primary arrester to the neutral wire.

As far as protection to the transformer is concerned, the use of the common neutral system described in the ELECTRICAL WORLD permits the complete protection of a transformer with but one arrester, not only a simplification of but also a marked improvement over the protective methods usual in the past.

E. BECK,
Circuit Breaker Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

BOOK REVIEWS

Business Looks at the Unforeseen

By W. B. Donham. Whittlesey House, McGraw-Hill Book Company, New York, N. Y. 209 pages

Nothing but inspired confidence, accelerated by a forced rise in prices of goods and securities, looks like a hopeful antidote for the ills of business. A cudgel is taken up in behalf of the farmer and an equalizing tariff put forth as an adjunct of a divided-market farm plan to bring him into economic parallel with the rest of the producing population. The merit attributed to the scheme is substantiated by its resemblance to the French mechanism of balancing agriculture and industry. France seems quite immune to the virus which has prostrated all other nations.

The Chase, Soule, A.F.L., Swope and Chamber of Commerce remedies are surveyed and each in some particular found wanting. The Hoover administration program as a whole is called "thoroughly sound and constructive" in the separate chapter devoted to it. The plea is that bold, drastic and dramatic gestures be applied in the execution of it so that the psychologic response will shatter the defeatist obsession.

"Business Adrift" spies a beacon and sights a channel.

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Composite-coil Electrodynamic Instruments

By F. B. Silsbee. (Bureau of Standards. Research Paper No. 411) Superintendent of Documents, Washington, D. C. 47 pages, illustrated. Price, 10 cents.

Design of new type of a.c. precision instrument which has an accuracy of 0.01 per cent. Fundamental theory of principle and design included in full mathematical detail.

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Funktionentheorie Und Ihre Anwendung In Der Technik

(Theory of functions and its application in engineering)

By R. Rothe, F. Ollendorff and K. Pohlhausen. Verlag von Julius Springer, Berlin W9, Linkstrasse, 23-24. 175 pages, illustrated.

This attractive slender volume makes available to the engineer the principles of analytic function theory and its various technical applications to engineering problems. The authors, R. Rothe, W. Schottky, K. Pohlhausen, E. Weber, F. Ollendorff and F. Noether, are well known in their respective fields. The first 75 pages are devoted to an exposition of the mathematical theory, including the definition of analytic functions, complex integrals, power series, residue theorem, conformal mapping, and contour integral treatment of Heaviside's operational methods. The remaining 100 pages are devoted to applications which comprise:

1. Two-dimensional electrostatic and magnetic fields, including treatments of the amplifying grid of a three-electrode tube, and fringing phenomena due to edge and corner effects in static condenser and machine poles and slots.
2. Ideal fluid flow, including the theory of the lift of an aerofoil.
3. Heat propagation and eddy current phenomena in solid cores of electric machines.
4. Radiation of high-frequency electric waves from an oscillator and their propagation over the ground, taking its finite conductivity into account.

This book should be very welcome to the theoretical engineer and the applied mathematician and to all those who are interested in applying theory and mathematics toward the arts. The great variety of problems treated points to the great reach and power of the analytic function theory and its methods.

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La Service Public Electrique

By M. A. Antoine. Published by Librairie de l'Enseignement Technique, 3 Rue Thénard, Paris (5). 106 pages, 8 illustrations. Price, 14 francs.

Intended for the information of the management of electric light and power enterprises, this little volume conveniently passes in review the various problems of organization, finance and public relations, which are evidently much the same in other countries as in the United States. In fact, the author freely refers to American practice in such matters as load building, the sale of appliances, advertising and inducement rates. He has evidently searched broadly for his material and has brought together methods used in Europe and on this side of the Atlantic. The reader who is looking for suggestions and the results of experience in other lands may benefit by the author's travels.

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Rewinding and Connecting Alternating-Current Motors

By Daniel H. Braymer and A. C. Roe. McGraw-Hill Book Company, New York, N. Y. 357 pages, illustrated. Price, $3.50.

Practical in arrangement, simple in language and convenient in manner of presenting data this book should fulfill the needs of motor service, plant electricians and, to a considerable extent, motor designers as well as trade school and technical students of design. Simple rules and profuse tables are provided for all changes of speed, voltage, frequency and horsepower ratings. Diagrams are lucid and, in short, the explanations of "why," illustrations of "how" and checks for "whether?" make it a composite text and handbook for the motor maintenance man and winding layout technician.

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Dielectric Phenomena

By S. Whitehead. Ernest Benn, Ltd., Bouveri House, 154 Fleet Street, London, E.C. 4, England. 338 pages, illustrated. Price, 30s.

The British Electrical and Allied Industries Research Association sponsors this work, which rounds out "I. Electrical Discharges in Gases" and "II. Electrical Discharges in Liquids" by the same author. The latest constitutes a compendium of research data on dielectric breakdown arranged according to such controlling factors as time, electrode arrangement, frequency, waveform, temperature, moisture and insulation composities. Subsequently the propounded theories are set up in apposition and their inadequancies disclosed. Mathematical support for the theories is confined to a 40-page appendix.

Men of the Industry

C. O. Dunten New President of Oklahoma Utility

Chester O. Dunten has been elected president and director of the Oklahoma Power & Water Company, Sand Springs, to succeed S. E. Wolff, who

took charge of the electric, gas and water utility interests formerly owned by the Page estate. Mr. Dunten is an electrical engineer, a graduate of Purdue University, and has had an active business career of 25 years. He went to Oklahoma from Illinois and Indiana and is well acquainted now with conditions in the Southwest.

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J. D. Ross has been reappointed superintendent of the city light department of Seattle, Wash., by John F. Dore, who recently became Mayor of Seattle.

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SAMUEL E. DOANE, consulting engineer, has been named a vice-president of A. F. Hatch & Company, Inc., with headquarters in New York. This company has been formed with the purpose of reorganizing and refinancing companies which are in distress. A. F. Hatch, president of the company, and W. de Wilder Atkinson, a vice-president, are well known in the investment banking field. Mr. Doane brings to the new undertaking a broad background of engineering and manufacturing experience. He was associated with the early activities of Thomas A. Edison and has been an outstanding figure in the electrical industry since 1886. For approximately 45 years he was identified with the lamp industry and has seen it grow from crude beginnings to the large organizations and elaborate lighting systems of today. It was in 1900 that he was made chief engineer of the National Lamp Association and then chief engineer of the National Lamp Works of the General Electric Company. He resigned from active executive service with the General Electric Company in July, 1930, to take up independent consulting work, with the General Electric as first client. Mr. Doane is a past-president of the I.E.S., fellow of the A.I.E.E. and a member of the A.S.M.E.

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WILLIAM M. HAND has retired as manager of the Kansas City office of the General Electric Company after 50 years of service in the electrical industry.

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G. M. GRIFFITH has returned to this country after spending seven years in Latin America, having been connected with the utility industry in Cuba, Costa Rica, Brazil and Venezuela. Mr. Griffith has opened consulting engineering offices in Atlanta, Ga.

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GEORGE E. STRINGFELLOW has been elected a vice-president of Thomas A. Edison, Inc., West Orange, N. J. Mr. Stringfellow was formerly identified in executive capacities with the Edison Storage Battery Company, which has been merged into the Thomas A. Edison organization.

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R. E. Fisher Heads Pacific Coast Association

R. E. Fisher, vice-president of the Pacific Gas & Electric Company in charge of public relations and sales, has been elected president of the Pacific Coast Electrical Association. He has been identified with the Pacific Gas organization since 1911 and in that period of time has directed his attention espe-

cially to sales and commercial activities. After ten years of service he was placed in charge of the commercial department, in 1922 was made vice-president in charge of sales and subsequently took over public relations work. Though Mr. Fisher is a native of the Middle West—Kansas, to be exact—he received his technical education in California. For many years he has been active in the National Electric Light Association on the Pacific Coast.

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L. A. Magraw Assumes New Duties in Chicago

L. A. Magraw has relinquished the presidency of the South Carolina Power Company, Charleston, to assume the duties of president of the Central Illinois Public Service Company, Chicago. He is succeeding in this office J. Paul Clayton, who resigned to become chairman of the board of directors of that company. Mr. Magraw will take office August 1. He has been prominently identified with the electrical industry in the South since 1909 and at the present time is president of the Southeastern Division of the National Electric Light Association.

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OBITUARY

W. W. Tefft

William W. Tefft, vice-president of the Fargo Engineering Company, Jackson, Mich., died June 24. Mr. Tefft was well known in the hydro-electric engineering field. In 1919 he became associated with Hodenpyl, Hardy & Company and later become chief engineer and vice-president of the Commonwealth Power Corporation and the Consumers Power Company. In 1928 he entered private practice as a consulting engineer and in 1929 became vice-president of the Fargo Engineering Company. Mr. Tefft was born at Milbank, S. D., in 1883. From 1902 until 1919 he was active in civil and hydraulic engineering and during that period he invented the Tefft conduit spillway, a method which has been very effective in reducing hydro-electric construction costs. He was a member of the A.I.E.E., A.S.C.E., A.S.M.E., N.E.L.A., the American Society of Engineers and the American Society for the Advancement of Science.

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W. R. HENDRY, who was engaged in the electrical industry in the Northwest for the past 25 years, died at his home in Seattle recently at the age of 57. Mr. Hendry was born in Montreal, and moving to Tacoma, Wash., entered the service of the Tacoma Railway Company, later becoming associated with the Seattle-Tacoma Power Company, the General Electric Company and the Fort Wayne Electric Company as Pacific Coast representative. In 1911 he established the W. R. Hendry Company, now located in Seattle.

New Equipment Available

Coupling Condensers for Obtaining Low Voltage

A unit type, dry coupling condenser has been developed by the Ohio Brass Company in conjunction with the Western Electric Company. It became apparent that a condenser which had an appreciable reactance at 60 cycles could be used as the medium for reducing the voltage wherever a limited current is necessary, which suggested the extended use of the coupling condenser to such operations as voltage indication, relaying and synchronizing.

The O-B coupling condenser units consist of a large porcelain tube with one closed end and with ordinary insulator petticoats or flanges at the other. These flanges provide the necessary leakage path between the inner and outer surfaces. These surfaces are metalized to form the condenser plates. The metal is applied by a special patented process which overcomes all possibility of it becoming loosened by differential expansion between it and the porcelain.

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Stainless Steel Motor

Whenever there is dust or dirt, moisture or fumes in sufficient quantity to clog an open type motor or to abrade or corrode its windings or bearings, there is the place, states the Lincoln Electric Company, to install its new stainless steel dustproof motor. This motor has the same dustproof design as its companions in the Lincoln line, but its inclosure and corrugated heat-radiating surface are made of stainless steel sheet, highly resistant to corrosion and insuring maintenance of heat-dissipating capacity under very adverse operating conditions.

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A NEW FORM OF OIL SWITCH, KNOWN AS "AN," designed for the remote control of the primary or the secondary of outdoor lighting transformers, is announced by the South Bend Current Controller Company. The switch rating ranges from 10 amp. at 7,500 volts to 100 amp. at 220 volts. The salient feature of this switch is the complete redesign of the auxiliary manual control mechanism.

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A LINE OF GEAR MOTORS, readily adaptable for application to machinery of widely various designs, is announced by the General Electric Company. The underlying principle consists of a normal speed motor in combination with a built-in, internal-helical planetary-gear speed reducer. A.c. polyphase, squirrel-cage and wound-rotor gear motors are available in ratings up to 75 hp., single phase to 5 hp. and d.c. to 7½ hp.

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A NEW DEVELOPMENT in high-wattage lamp construction which is a radical departure from traditional design is announced by the General Electric Company. The new problem of high-wattage lamp design has led to a simplified construction using fewer parts and changing the entire operation of lamp fabrication. Starting with two copper prongs which serve as a base, and to which a special heat-resisting glass cup is sealed, the entire internal structure is built up from the prongs and the bulb is sealed to the glass cup as a final operation.

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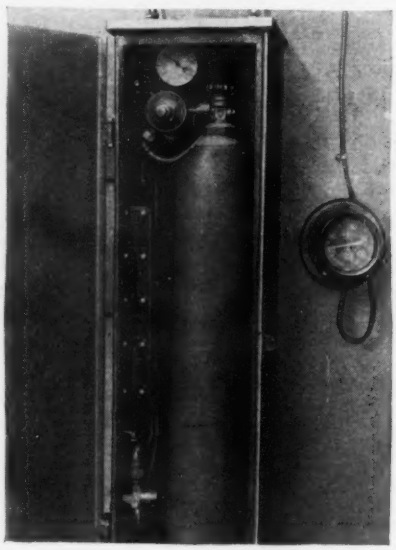
Inertaire Equipment Aids Transformers

A new device which extends the advantages of "Inertaire" protection to small transformers and offers an improved method of supplying nitrogen to large Inertaire power transformers is announced by the Westinghouse Electric & Manufacturing Company. Operation of transformers with inert gas above the oil level prevents oil and insulation deterioration.



The new equipment consists of a 200-cu.ft. nitrogen cylinder with an ingenious reducing valve which automatically meters the nitrogen to the gas space of the transformer, an alarm pressure gage, a breathing regulator and a sampling valve.

Some of the advantages claimed for this equipment are that it will operate with absolute safety to all the connected equipment and give many years of service and a positive gas pressure can be maintained in the transformer.

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New Load Possibilities with "Dunco" Peak Limiter

A peak limiter which automatically limits the maximum load demand with preference to the immediately essential appliance, known as "Dunco," is announced by Struthers Dunn, Inc., Philadelphia, Pa. The set consists of two interconnected relays mounted in an aluminum finished hinged cover knock-out box measuring 8½ in. high by 10 in. wide by 4 in. deep.

The characteristics of each of these relays may be varied in a number of ways, making it possible to alter the characteristics of the complete device so that it is suitable for application under widely varying operating conditions. The right-hand unit has single-pole, double-throw contacts and is provided with a current-operated coil. In the majority of instances this coil is built in two sections, one of which is placed in series with each side of a three-wire, 220-volt line, so as to compensate for unbalanced load conditions.

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Disconnecting Switch for Voltages from 69 to 161 Kv.

A new outdoor type disconnecting switch, known as type 188 rotating insulator thrust-blade disconnecting switch, is announced by the Electric Power Equipment Corporation, Philadelphia, Pa. This switch was designed to meet the demand for a vertical-opening, group-operated switch in voltages from 69 to 161 kv. inclusive and standard capacities of 600 and 1,200 amp. The switch is of the three-insulator type per pole and can be furnished for upright, underhung or vertical mounting and does not require the use of counterweights or counter-balance springs in its operation. When the main blade is lowered to the closed position and before contact is thrust home, the blade is hooked over a contact casting which locks the three insulator stacks together through the main blade and prevents undue cantilever strains being imposed on the contact insulator stack.

When the main blade is lowered by means of the turning insulator an irregular motion is transmitted to the thrust blade through the full-floating contact, effecting a wiping and scouring action of the entire surface of the contact, preventing the wearing of any certain path. This switch can be operated by hand or electric motor.